

NEW 10-CORE INTEL CPU

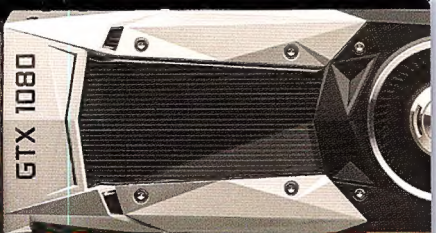
CHIPZILLA'S NEW
'MEGA-TASKING'
PROCESSOR ON TEST

2100

July 2016
Issue 430

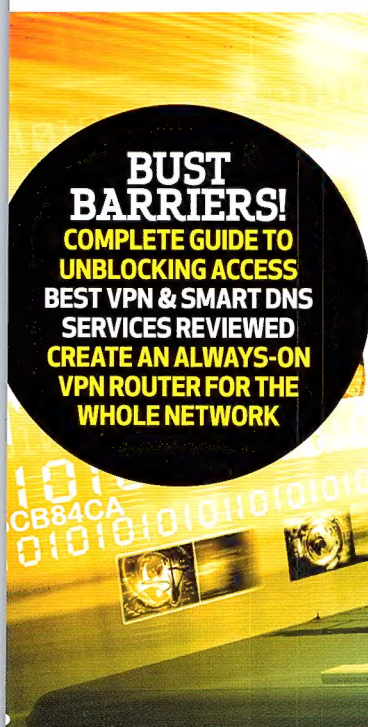
YOUR EXPERT

GUIDE TO TODAY'S TECH



**GEFORCE 1080
SMASHES
RECORDS**

IS THIS THE
ULTIMATE GPU
FOR VR & 4K GAMING?



**BUST
BARRIERS!**

COMPLETE GUIDE TO
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BEST VPN & SMART DNS
SERVICES REVIEWED
CREATE AN ALWAYS-ON
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WHOLE NETWORK

**SOLVE
WINDOWS 10
INSTALL
PROBLEMS**

Essential tricks and
techniques to get
Microsoft's latest installed

**FIRST
QUANTUM
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Is this the next
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GET UNRESTRICTED ACCESS

SMASH INTERNET GEOBLOCKS

GET ANYTHING FROM ANYWHERE: THE SERVICES, APPS AND TECHNIQUES YOU NEED TO KNOW

TUNE UP YOUR TECH SKILLS

- Run Ubuntu Linux on a tablet
- Build a custom water-cooled desktop gaming PC
- Code your own benchmarks
- Use a Raspberry Pi for Mac Time Machine backups

COOLEST NEW TECH & PC GEAR RATED

- Best wireless mouse ever: Logitech's no-lag G900
- Fast and durable portable storage: Samsung's T3 SSD
- Razer's supersleek ultrabook: a 12-inch MacBook killer?

USB TYPE-C ACCESSORIES

Your new PC's got the port — now here's all the gear you can plug into it!

LABS
TESTED!



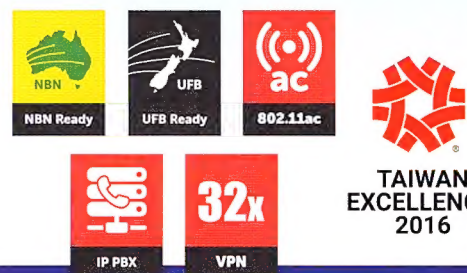
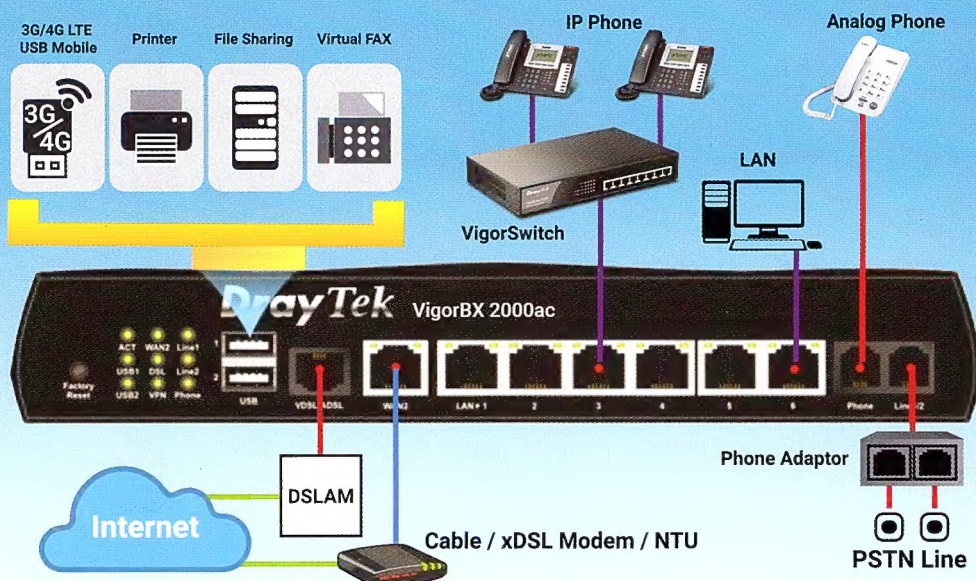
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Fight for your right to bust geoblocks

Even the Australian Government has
supported the consumer when it comes
to video-streaming parties. APC's editor
Dan Gardiner explains.

The continuing digital
revolution has helped to
break down many borders,
reshaping the way business
is done and upsetting old regional
trade arrangements.

We think most people would
agree that trying to artificially
restrict markets is bad for both
businesses and consumers. But it
actually happens all the time – and
Aussies are often at the rough end of
the stick when it comes to pricing
for digital goods and services.

Take Netflix, for example. The
service which calls the US home has
almost 6,000 titles (combining
movies and TV shows) on offer in
the States. In Australia, that
number is around 2,000. While some
territories do have it worse (Hong
Kong and Taiwan only have about
520 a pop), Australia is towards the
bottom end of the curve – Mexico
has more, at about 3,000 titles.

Of course, for those in the know,
getting around the so-called
geoblocks that prevent you from
watching another locale's library is
child's play. While there aren't any
Australian laws specifically
protecting the circumvention of
geolocation blocks, there aren't any
that prohibit it either. And in fact,
two separate government reports
have come down on the side of the
Australians in cases involving the
pricing and availability of digital
goods and services. The first of
those was released in July 2013 and
stated quite plainly that "in many

cases, the price differences for IT
products cannot be explained by the
cost of doing business in Australia".

At the end of April, a new report
put out by the Productivity
Commission reiterated that report's
findings, stating: "The Australian
Government should implement the
recommendation... to amend the
Copyright Act 1968 (Cth) to make
clear that it is not an infringement
for consumers to circumvent
geoblocking technology. The
Australian Government should seek
to avoid any international
agreements that would prevent or
ban consumers from circumventing
geoblocking technology."

At present there's nothing
specifically enshrining those rights
in Australian law – thus, we've got
no legal recourse should a company
put those blocks in place. And the
bigger names are certainly trying:
Netflix's current crackdown on VPN
and smart DNS services is an
ongoing effort. As such, when
choosing a VPN or smart DNS like
those we've reviewed in this month's
superguide, we'd recommend not
overcommitting when it comes to
subscribing. ■

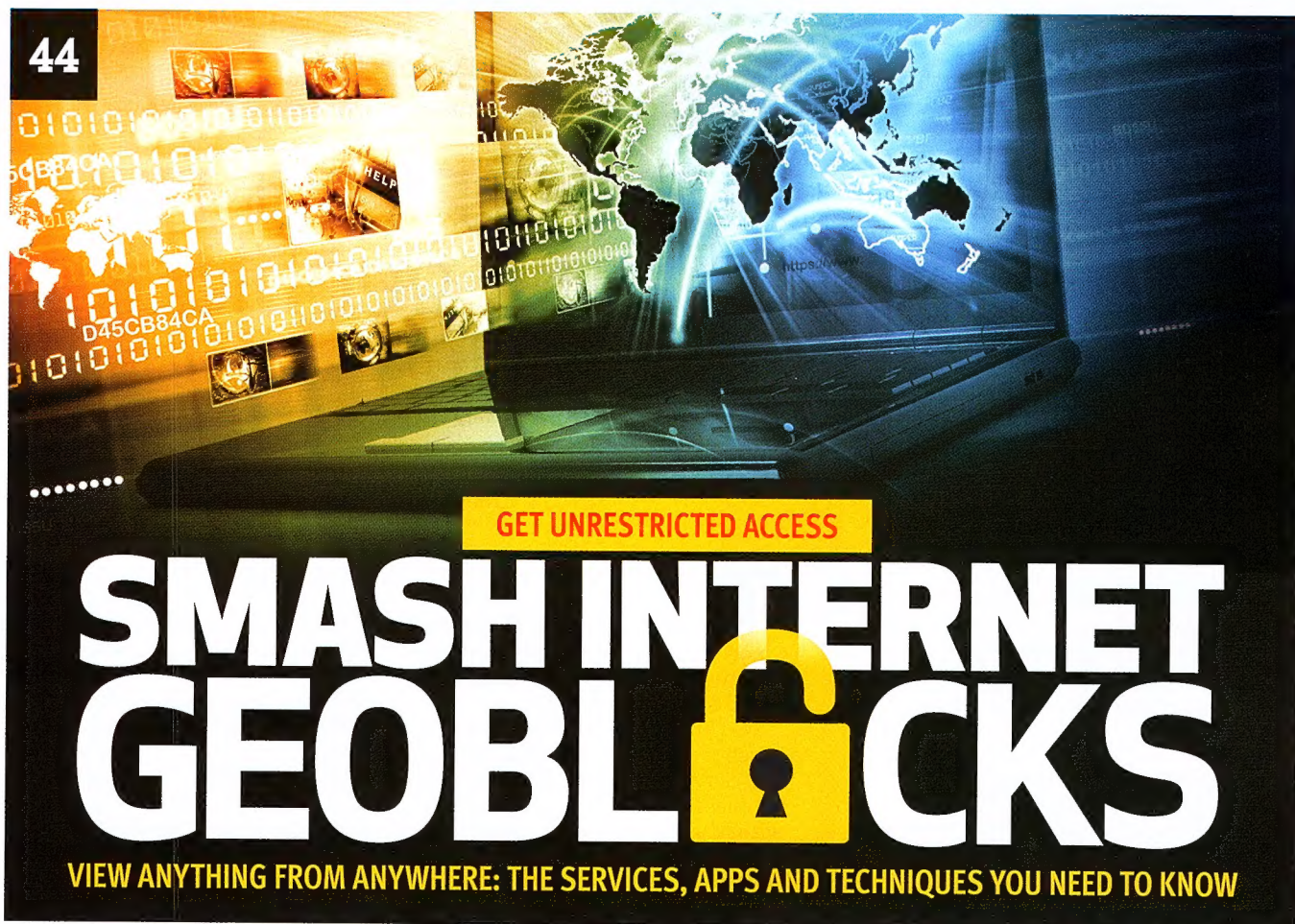


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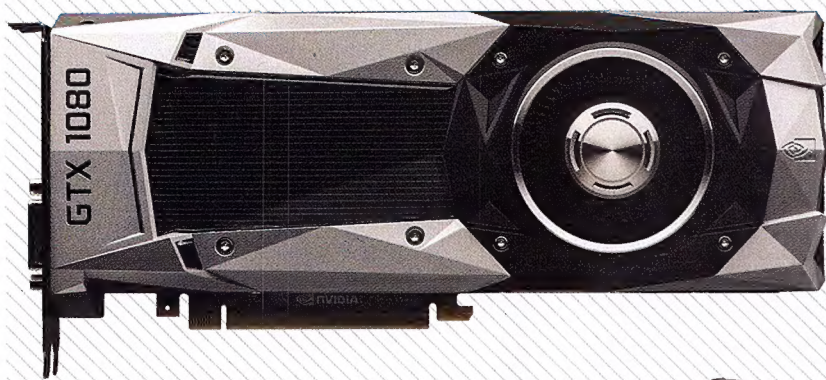
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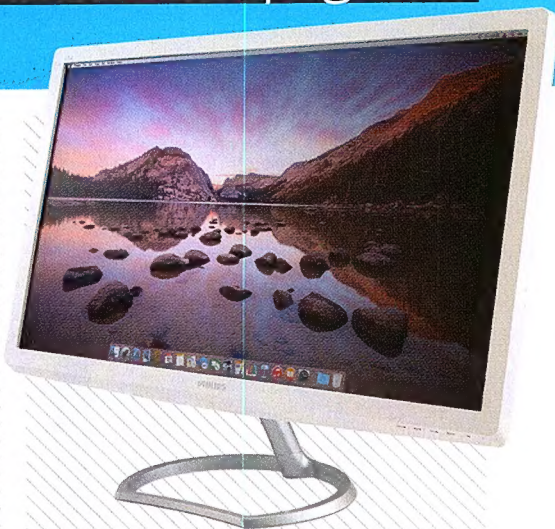
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"It makes 4K gaming accessible. It's not a flawless 60fps experience in AAA titles, but we're almost there."
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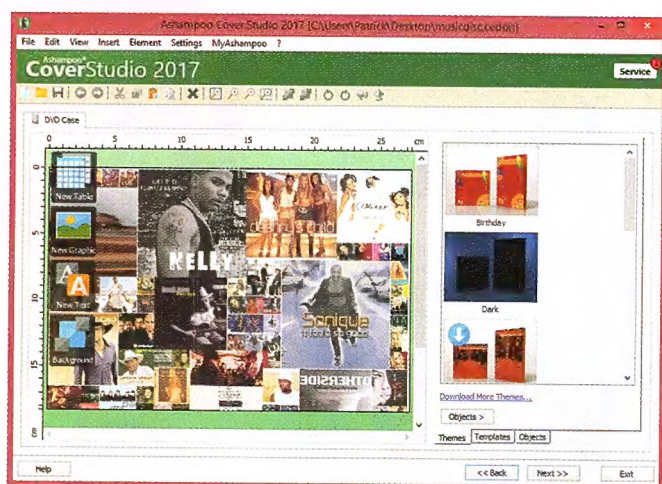
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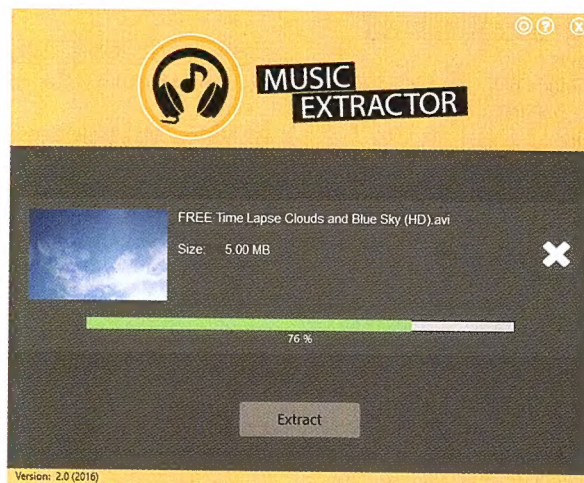
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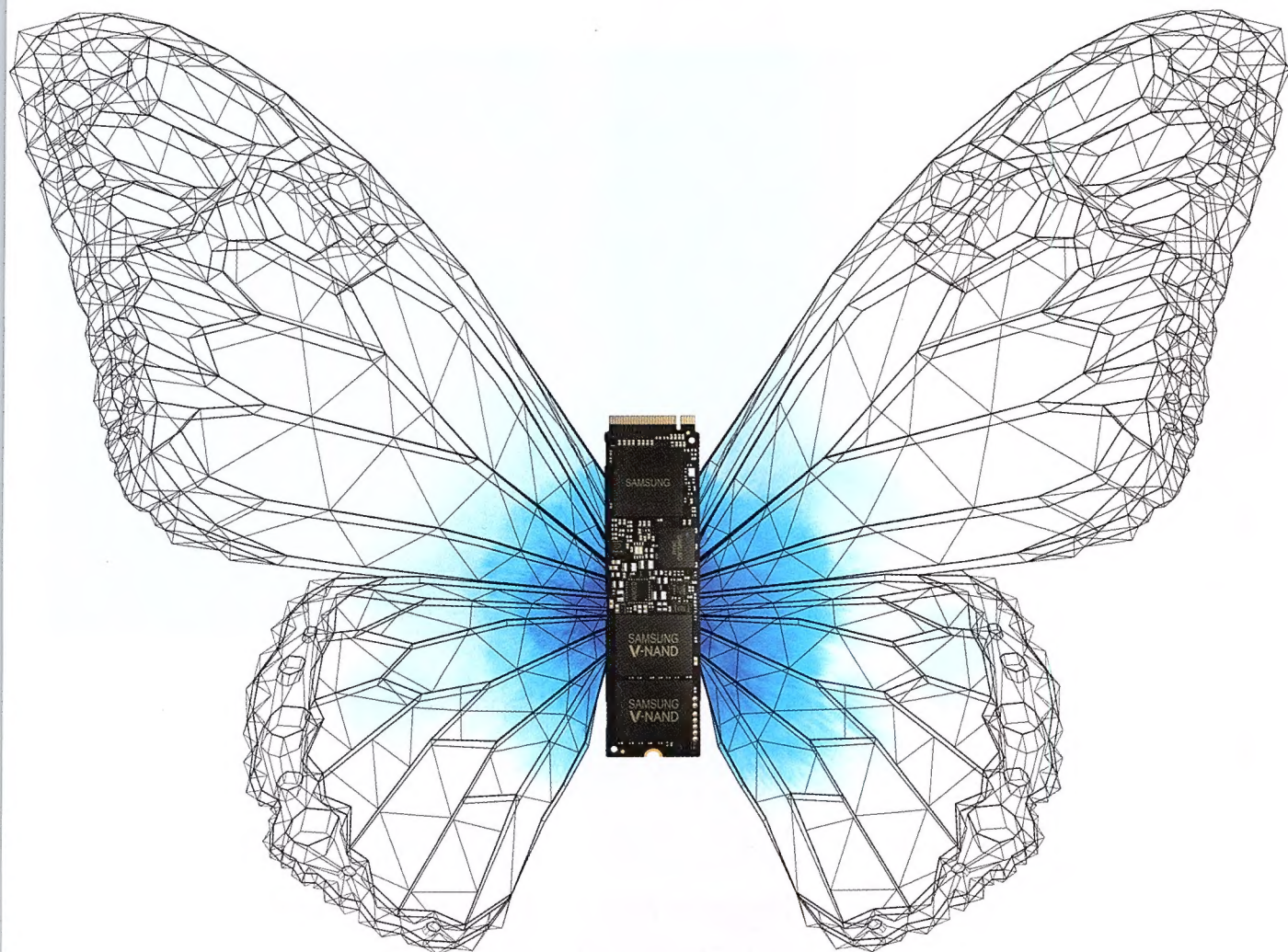
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Tasmanian *Game of Thrones* pirate offers to send HBO \$10 per episode

COMPARES FOXTEL TO CHEAP INDIAN FOOD.

Sick of Foxtel's monopoly on *Game of Thrones* in Australia, Taswegian John Hyslop has offered to send HBO \$10 for each torrented episode. In his post to HBO's Facebook page, Hyslop compared using Foxtel to "hitting up an all-you-can-eat banquet at a cheap Indian restaurant", bemoaning that "even waiting for a memory stick to come by mail would be a better option". SL

Storage industry continues to get crunched, as WD buys SanDisk

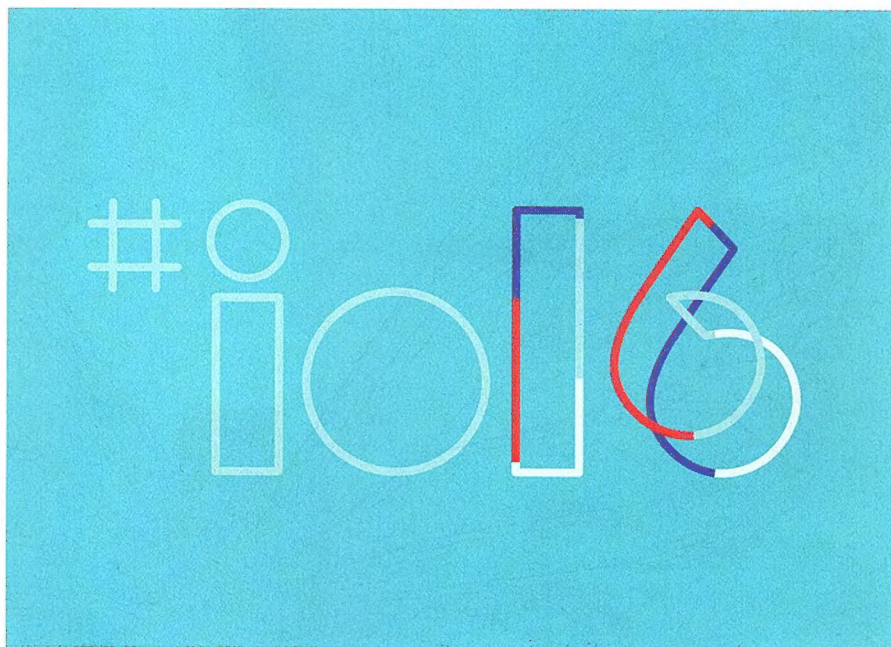
AND IT'S PAYING A PRETTY PENNY FOR IT, TOO

Having cleared all the regulatory hurdles that usually go with enormous tech company acquisitions, storage powerhouse Western Digital has announced that it's spending a staggering \$19 billion on the purchase of SanDisk, the world's leading flash storage company. The deal makes SanDisk a wholly owned subsidiary of WD, bringing with it the company's substantial shares in the flash storage, USB stick and SSD markets. SL

Ransomware perpetrators promise to donate proceeds to charity

BECAUSE THAT MAKES IT ALL FINE, YEAH?

Ransomware is a particularly malicious form of computer virus that encrypts a victim's files and literally holds them to ransom, demanding a sum of money (often in bitcoins) for their safe return. CryptMix is one such virus; however, the message the victims receive claims that the thieves are not stealing their money for selfish reasons. "Your money will be spent for the children charity," it claims. "Many children will receive presents and medical help!" Yeah, sure... CS



Google embraces VR, AI and wearables at 2016 dev conference

The biggest and best announcements out of Google's I/O 2016 keynote.

Google had a lot to crow about at its I/O keynote this year, announcing a spate of impressive new experiences that will guide the Alphabet company into the foreseeable future. Setting its sights on smartphones, VR, and even the home itself, Google wants a hand in improving every aspect of your daily life.

Though virtual assistants are not exactly new to Google, with Google Now currently acting in a similar way to Apple's Siri and Windows's Cortana, the tech giant knows they can be better, which is why it announced the aptly named Google Assistant. Touting a similar experience to Google Now, Google Assistant will one-up its predecessor by learning and conversing with you, changing its responses based on your follow-up statements and questions.

Speaking of virtual, Google intends to take its Android VR platform further than ever before with Daydream, a VR framework that may or may not incorporate a headset and Wii-like remote.

With Google Home, the search king announced its intention to take over your living quarters, revealing an Amazon Echo competitor which effortlessly ties your connected devices together, much like a nice rug does to your room. Sensitive microphones allow you to give Google Home commands, whether you want to control your Chromecast, adjust your Nest thermostat settings, or simply ask Google a question.

Next came Allo and Duo, a pair of apps designed to be Google's answer to Apple's iMessage and FaceTime apps. Allo is an encrypted, cross-platform messaging app that uses Google's search smarts to predict possible responses for fast replies, while Duo lets you make video calls that scale in video quality depending on available bandwidth.

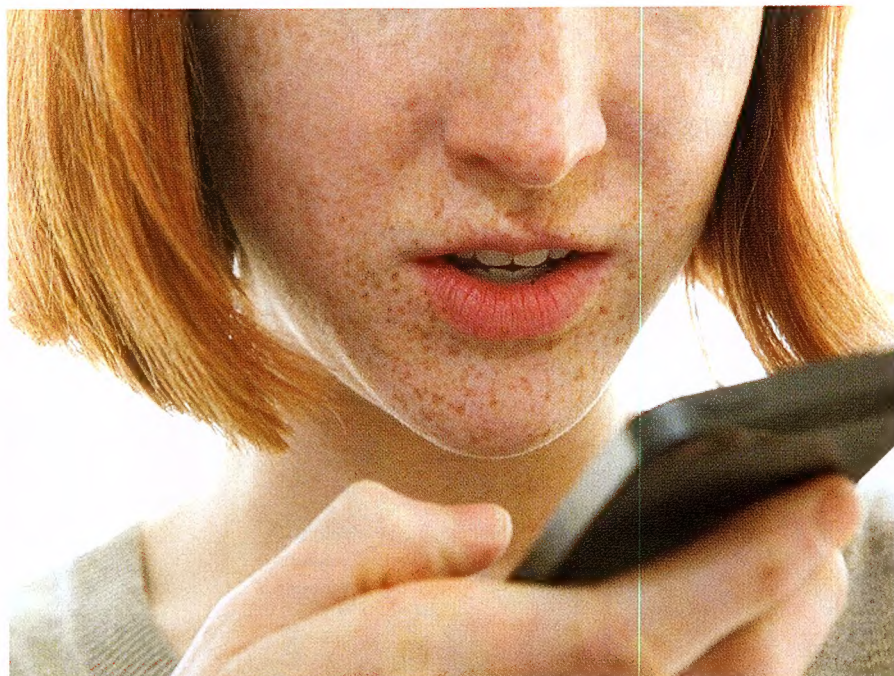
Finally, Google showed off Android Wear 2.0, which has a refined focus on fitness and ease of use, boasting many features that can be used without a phone. Stephen Lambrechts



Australian Government commits \$230M to help fight cybercrime

MILLIONS TO POTENTIALLY SAVE BILLIONS.

Having admitted that Australia routinely falls victim to cybercrime, Prime Minister Malcolm Turnbull has announced a new \$230 million Cyber Security Strategy. Turnbull stated that the plan "adds to our credibility as we promote norms of good behaviour on the international stage, and importantly, familiarity with offensive measures enhances our defensive capabilities as well". The plan, which will be laid out over the next four years, will firstly spend \$39 million relocating the current Australian Cyber Security Centre, and then a further \$47 million building intelligence-sharing centres in each of Australia's major cities. According to the Prime Minister's report on the matter, cybercrimes cost Australians an estimated \$1 billion annually, though the actual repercussions of cybercrime could cost the nation as much as \$17 billion each year. Though the rest of the plan has yet to be spelled out, Turnbull said that it would "develop partnerships between the Australian public and private sectors, support home-grown cyber security capabilities and promote international cyber cooperation". SL



Ex-Siri devs aim to beat Apple and Google with new voice assistant

Next-gen AI can handle complex questions and might actually work.

Apple acquired Siri in 2010 from SRI International, and now the devs behind the technology (Dag Kittlaus and Adam Cheyer) have revealed her secret progeny. After being in development for four years, 'Viv' was debuted at TechCrunch's Disrupt NY 2016 and is being said to possess even more potential than his/her predecessor. According to the devs, Viv can connect seamlessly with third-party services to perform complex tasks and answer multi-element questions, such as "Will it be warmer than 70 degrees near the Golden Gate Bridge after 5pm the day after tomorrow?" Now, while Siri is still very powerful, Viv may just surpass Apple's AI assistant due to the open design of its system and the number of useful services that Viv will support in the future.

Viv's release date has not yet been determined, so Siri doesn't need to send for the Huntsman just yet. But whatever happens next, it looks as though a fully integrated system like Tony Stark's JARVIS is not too far away.

Carmel Sealey

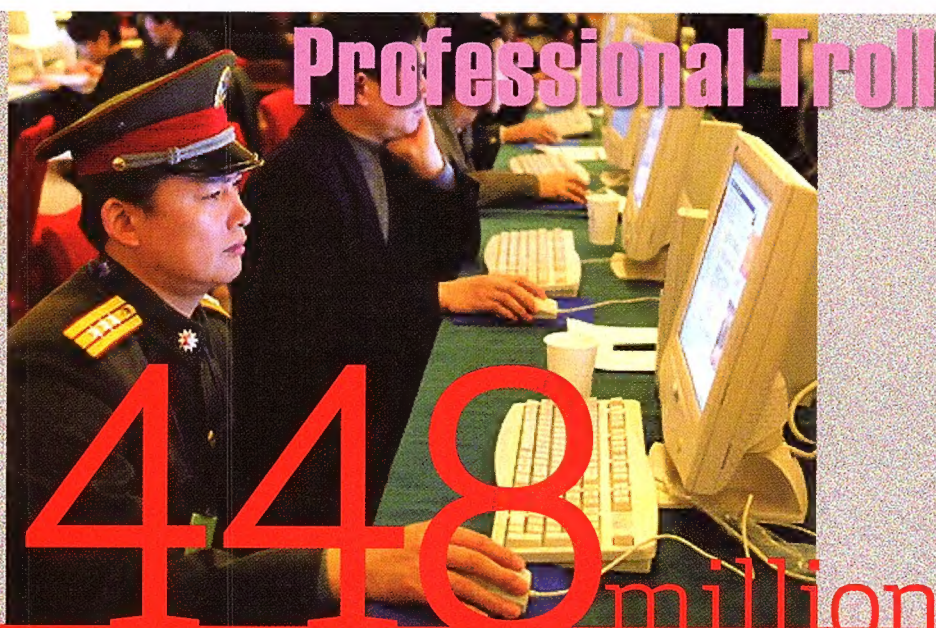
Aussie three-strikes law thrown out

ISPs AND MEDIA COMPANIES FAIL TO REACH AGREEMENT ON CONTROVERSIAL ANTI-PIRACY SCHEME.

Remember the 'three strikes' anti-piracy scheme once proposed by (then Communications Minister) Malcolm Turnbull, which would send copyright infringers a couple of warning notices before taking legal action? Well, it appears the plan has been quietly ditched over a failure to reach an agreement over its cost. In a joint letter from the Communications Alliance and Foxtel, it's been revealed that each of the involved parties, including Village Roadshow, ARIA and the Australian Screen Association, had "not proved possible to reach agreement on how to apportion all of the costs." According to Comms Alliance CEO John Stanton, the parties weren't able to agree on the schemes processing costs, which would go towards writing the notices, contacting alleged infringers and dealing with irate responses from the accused. Though there'd been discussions of an automated system for those kinds of tasks, Stanton stated that "it is possible to largely automate it, but that's quite an expensive undertaking," noting that the estimated cost would be in the "multiple millions." SL

technotes

» JOEL BURGESS LOOKS AT THE NUMBERS DRIVING THE NEWS.



THE NUMBER OF BOGUS SOCIAL MEDIA POSTS PLACED BY CHINESE GOVERNMENT REPRESENTATIVES EVERY YEAR.

The army of paid online advocates for China's current ruling political party — colloquially known as the 50 Cent Party after how much they earn per social media post — were once believed to be ordinary citizens coerced by monetary incentives to show online public support for the regime. New research from Harvard University researchers suggests, however, that 99.3% of the posts made in 50 Cent Party campaigns actually come from civil servants employed in various governmental departments.



€3BN

HOW MUCH GOOGLE COULD BE FINED AFTER EU ANTITRUST INVESTIGATION.

The ongoing investigation by the European Commission into Google's alleged tweaking of search results to favour its own products and services is finally coming to a head. After seven years of investigation, the tech giant looks like it'll be facing a record-breaking fine. At the time of writing, the UK's *Telegraph* had reported that sources close to the matter believed the fine could be more than €3BN — about AU\$4.66BN. The official amount should be finalised around the time you're reading this issue of APC.



US \$20_{ph}

HOW MUCH GOOGLE IS PAYING PEOPLE TO NOT DRIVE ITS SELF-DRIVING CARS.

If you're an Arizona resident that happens to have a clean driving record, a university degree and can type 40 words per minute, you may just be the next Google employee. Though we'd generally assume that this was a pretty lax hiring criteria for one of the most technically advanced companies around, that's all you'll need to qualify for a position that requires you to do little more than watch Google's cars drive themselves.



60,000

THE NUMBER OF FOXCONN EMPLOYEES REPLACED BY ROBOTS.

A factory in China run by Apple's main manufacturing partner, Foxconn, more than halved its workforce on a single day in May and replaced the labourers with automated robotic systems. According to a report by the South China Morning Post the 60,000 workers that were made redundant in lieu of robots is reflective of a bigger trend with up to 600 companies in the area suggesting plans to automate workforces.



65million

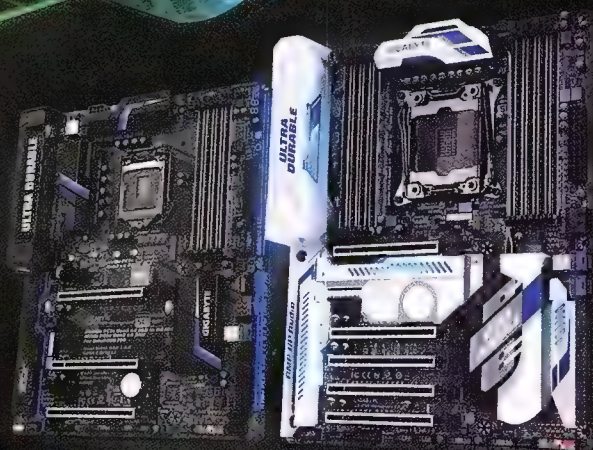
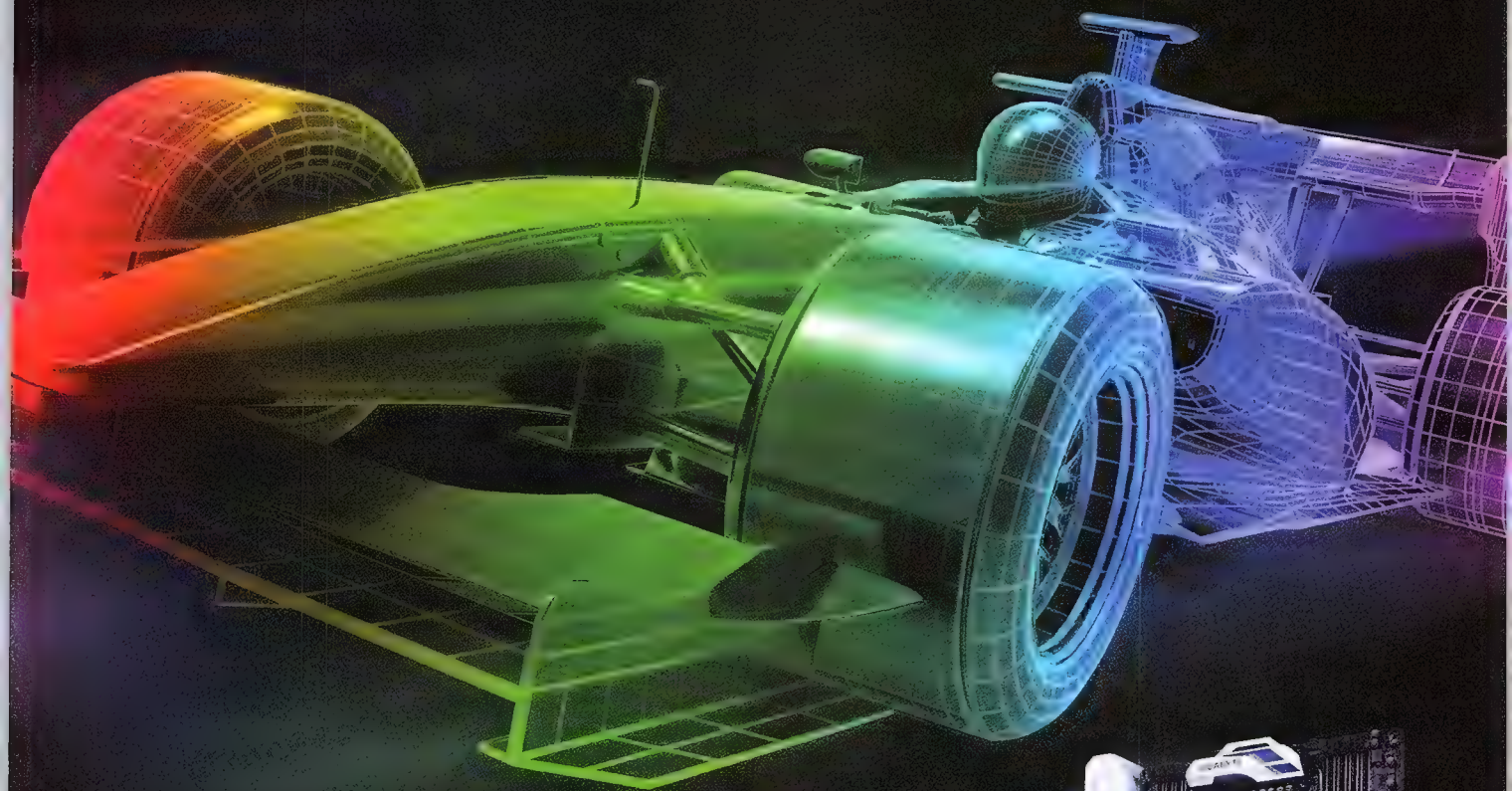
GRAND THEFT AUTO V SALES NOW ONLY 5 MILLION AWAY FROM MINECRAFT'S RECORD.

Minecraft has held the title as the best-selling PC game ever and the third-best selling video game, but it looks like Rockstar's *Grand Theft Auto V* is bent on narrowing the gap. After the game sold an additional 5 million copies between February and May this year, the CEO of the game's publisher, Take-Two Interactive, said the 2013 game's performance was continuing to exceed sales expectations. *GTA V* is currently the 4th highest selling game, coming in behind *Minecraft*, *Wii Sports* and *Tetris*.

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technotes

» GEAR WE WANT

DRAGONBOX PYRA

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Though it might be about the size of the original Nintendo Gameboy, the almost-pocketable DragonBox Pyra is a mini PC that can run a full Linux operating system. The open source system has been designed with gaming in mind, including a combination of both a full keyboard layout and an additional controller layout that's comprised of pair of joysticks, a gamepad and gameplay buttons. While the Texas Instrument's OMAP 5 SoC powering the Pyra won't blow anyone away, it does offer good modularity for a device of this size and you can choose either a 2GB or 4GB RAM configuration straight off the bat. With a 5-inch display, 6000mAh battery and impressive selection of connections, this looks like an interesting crack at the pocket PC concept. [JB]



PICTAR

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There are many smartphone accessories that claim to revolutionise your phone's photography, but few are as interesting as the Pictar. It's a DSLR-like grip for iPhones that massively extends its camera's capabilities. From a multistate shutter release to zoom control, exposure compensation wheel and a customisable 'smart wheel', Pictar should give you much more control over the pictures you shoot. It's even got a cold shoe mount so you can attach lighting accessories, and a tripod socket too. It's the ideal accessory for taking your iPhone-ography [That's a word, right? - Ed] to the next level.

PLANTRONICS BACKBEAT PRO+

\$419 | WWW.PLANTRONICS.COM

The second generation of Plantronics bluetooth powerhouse takes the already amazing ingredients of the Backbeat Pro and adds a little extra spice. It's a laundry list of great features: rock-solid, Class 1 Bluetooth; active noise cancelling that doesn't thicken up the sound quality; NFC; open-mic feature to let you hear your surroundings; and *deep breath* a smart sensor that auto plays and stops the sound when you take off the headphones. On top of this, Plantronics has bundled in a high-fidelity USB adapter for your PC or Mac. A winner. [TC]



SAMSUNG UBD-K8500 UHD 4K BLU-RAY PLAYER

\$599 | WWW.SAMSUNG.COM/AU

If you've bought premium TV in the past year or two, chances are it'll be compatible with Ultra HD (aka 4K) content, but unless you also have Netflix and a reasonably-fast internet connection, there's little in the way of 4K content on offer. That's about to change, as UHD Blu-ray discs and players begin to emerge in Australia. Back in April, Panasonic announced that it's launching a 4K Blu-ray player in September, but Samsung has actually beat Panasonic to the punch by simultaneously announcing and releasing its own player in May. Samsung's UBD-K8500 is priced at \$599 locally, while the competing Panasonic DMP-UB900 unit is expected to cost closer to double that. [JB]



SMARTER FRIDGE CAM

\$TBA | SMARTER.AMV

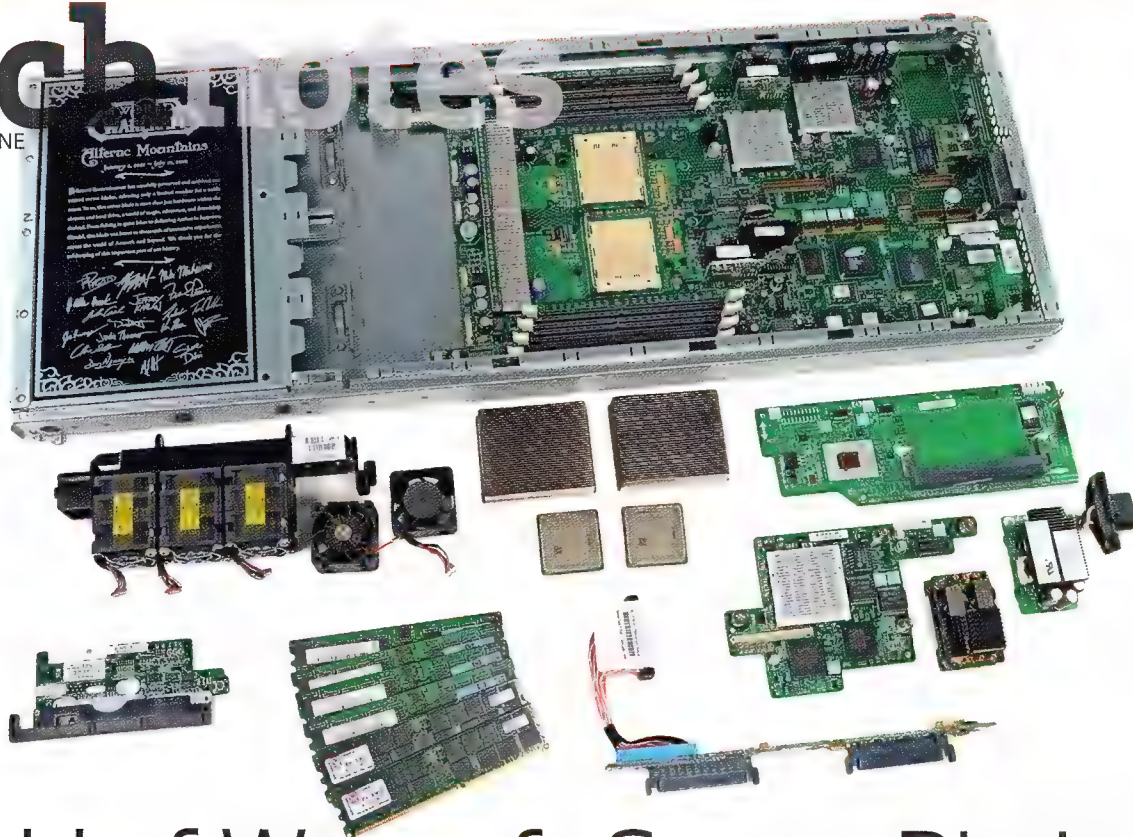
Samsung's internet-connected Family Hub Refrigerator is a bit much, but if you want to get your cold storage online without spending over \$7,500, you could look to the new Fridge Cam instead. Developed by Smarter, the company behind the iKettle, it sits in your refrigerator and takes snapshots of the contents for you to view on your phone, enabling you to quickly check to see if you need to grab milk on the way home. Smarter is yet to confirm the pricing, but it'll undoubtedly be cheaper than buying a new appliance.



MSI VR GAMING BACKPACK

\$TBA | AU.MSI.COM

Virtual-reality headsets that utilise a full desktop GPU offer a quality that simply can't be matched in a smartphone-powered VR experience. That said, the latter have one massive advantage over the likes of the Oculus Rift and the HTC Vive: there are no clunky cables tethering you to the required PC. In an attempt to mitigate the impact of needing thick HDMI cables to connect a fully-fledged VR headset to the gaming PC running it, MSI showed off a powerful gaming PC backpack with a reported 90-minute battery life at Computex in May. Granted, you'll still need cables from the backpack to the headset, but the jetpack-esque portable PC will allow you to move more freely by effectively cutting all physical ties to the outside world. [JB] ■



World of Warcraft Server Blade

Once upon a time, this held the chat of all the players of Alterac. Probably.

BACKGROUND:

Behold! We hold the World of Warcraft in our hands! OK, fine. Maybe just a part of it. Or a part of a part of it. And it doesn't really fit in our hands. When Blizzard decided to upgrade its servers, it sold off the old equipment as collector's pieces. Prepare to be WoWed as we take a look inside the insides of the *World of Warcraft*.

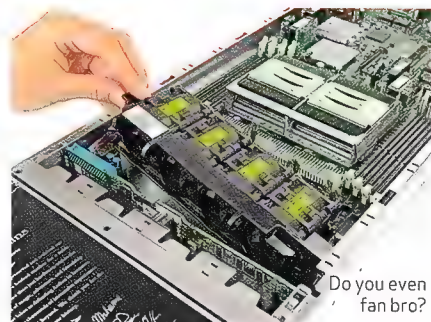
MAJOR TECH SPECS:

- 2 x dual-core AMD Opteron 275 processors @ 2.2GHz
- 6GB (2 x 2GB & 4 x 512MB) HP DDR-ECC RAM @ 400MHz CL3
- HP Smart Array 6i SCSI controller card
- Broadcom BCM5704CKFB Ethernet CTLR single chip 10/100/1,000 300-pin HBGA
- Rage XL 215R3LASB41 graphics
- Compaq 170095-002
- Pulse H5007 1000BASE-T magnetic modules
- NetPHY AM79C874VC low power 10/100-tx/fx Ethernet transceiver

KEY FINDINGS:

- This particular server blade is an HP ProLiant BL25p that Blizzard decked out with a commemorative plate. It's one of several server blades sustaining the Alterac Mountains from January 4, 2007 until July 21, 2010.

- The transparent panel covering all the mechanical madness inside provides shoddy protection, but is nonetheless ornate. -10% armor. +15% intellect.
- Twisting a few knobs is all that's required to remove the SCSI controller, responsible for interfacing with hard drives, scanners, tape drives, and other alliance technologies.
- The DC power filter has an input of -43V - 57V at 13A max. That's 546 watts of maximum power! As this is just a power filter, not a transformer, the output is almost the same: -43V - 57V at a maximum 12.4A. Once the server juice has been filtered, it is converted to the correct voltage by the power converter — two identical modules on top of each other, using the standoffs between them as a power relay. The output is 12V, 40A, for a whopping 480 watts.
- The WoW server blade has two dedicated hard drive bays: "A device or blank must occupy all bays during operation."



- A T15 Torx screwdriver is strong enough to slay any beast, including that which stands in the way of removing this mobo.
- Repairability Score: 10 out of 10. No security screws; modular, easy-to-access components. HP provides online maintenance repair documentation. It should be noted that these server blades are designed to be easily maintained and eventually disposed of. We appreciate HP being so mindful of the repair and maintenance aspect of its products. ■

About iFixit

iFixit is a global community of tinkerers dedicated to helping people fix things through free online repair manuals and teardowns. iFixit believes that everyone has the right to maintain and repair their own products. To learn more, visit www.ifixit.com.

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technotes

EPINIONS

"Please be aware that powerline devices are doing in essence the electromagnetic version of a poorly managed rubbish dump in a wind-storm that's allowing paper, plastic, and so on to fly in all directions."



POWERLINE POLLUTION

Thank you for the informative article on powerline adapters in the April issue of *APC* (see page 53).

Coincidentally, the President of the Wireless Institute of Australia (WIA), Mr Phil Wait, also talked about these devices in his article in *Amateur Radio* magazine for April 2016 (Vol 84, Num 4). However, his description of these included "Let's call it what it is – Electromagnetic Pollution, where every unwanted noise source just adds to the pollution level. It is the WIA's view that, in order to protect existing and emerging technologies, we must maintain the strongest vigilance against radio noise pollution from all identifiable sources."

Mr Wait described in some detail how the Australian Communications and Media Authority (ACMA) has required compliance by device manufacturers and importers with the International Standard CISPR-22. The standards muddle has been extended with a new European standard, EN50561-1, essentially the same as the international standard. However, ACMA has had difficulty getting assurances that powerline devices meet the standards, including that the devices use 'notch' filters to protect various radio bands including broadcasting, aeronautical, and amateur radio. The WIA's investigations have also shown clearly

that many powerline devices do not use 'notch' filters.

So, please be aware that powerline devices are doing in essence the electromagnetic version of a poorly managed rubbish dump in a wind-storm that's allowing paper, plastic, and so on to fly in all directions.

Peter Ellis

NO SMARTPHONE FOR ME, THANKS

In response to the 'FBI vs encryption' editorial in *APC*'s April issue (see page 3) I do not have, and do not like, the so called 'smart mobile phones'. My current mobile is a standard Nokia C2-01 which does have internet and email capabilities but I have no desire to activate them as they are just money makers for the service providers – it does all that I require. As I understand 'smart' phones, even if the apps are free you are still paying for any connection costs required to use the service being provided as well as any ISP access costs. So, on count one, smart phones are not for me. If 'dumb' phones ever cease being manufactured and only smartphones are available, nothing will change as I would never activate an internet connection via it. That is why I have a landline/fixed phone line for phone/fax/internet, and if I'm not at home I can use a PC at either a public library or a relatives' place.

That said, I am still a strong supporter of the adage "nothing to

hide, nothing to fear". If and when I ever get an SMS message, which for me are, by definition, all spam, they're immediately deleted, as is any record of incoming and outgoing phone calls as soon as possible after the call ends. I may check them first, but if it's an SMS message referring to a missed phone call, no further action is taken and the message is deleted (unless I recognise the source phone number when the call may be returned if it is still fresh, after which it will be deleted). If it's outdated, it would be deleted in the normal course of events.

Regarding the FBI vs encryption, if you do not support crime fighting then by implication (as far as I am concerned) you are in favour of the criminals getting away with their crime. I understand that the FBI did finally find a way to access the phone of the terrorist and I assume that this could only be by finding a way to decode the encryption which gets Apple off the hook and protects their rights to protect criminals from prosecution and ending up where they should be – in gaol. My mobile phone hasn't had the defaults changed. People might say that we all have something to hide. If so, don't store it digitally. Keep it in your head if you have a good memory, or find some other way to protect it.

Paul Myers ■

APCMAG@FUTURENET.COM

Come on, have your say!

We want to hear what you think. Add to these discussions or email your views (in fewer than 250 words) to apcmag@futurenet.com. All correspondence becomes the property of *APC* and is subject to editing. Letters must include full name, street address, suburb, state and phone number to be considered for print publication. Address and phone details will not be published.

Windows 10 is determined to be your OS — even if you don't want it to be

Many users — and even China's authorities — are fed up with Microsoft's invasive update strategy. Shaun Prescott reports.

Back in 2014, when Microsoft announced that owners of Windows 7 and 8 would receive Windows 10 as a free upgrade, it was widely accepted as a positive move. Who doesn't like free stuff, especially when it's a usually-costly operating system revamp? Then, as the months wore on, users and commentators started to realise the negative aspects of that strategy. What if you don't want constant reminders to purchase the Microsoft Office suite? What if the company's data collection is one privacy indiscretion too far for you? What if you just like your older OS?

As time goes by, avoiding the Windows 10 upgrade has become more and more of a hassle. Recent viral videos have showed the effects of disastrously-timed updates on users — a live weather broadcast was interrupted when the PC powering the

graphics suddenly started installing the upgrade, and a *Counter-Strike* streamer's nine-hour session was terminated mid-game by a forced upgrade. The temerity of these forced updates has prompted some to deactivate Windows Updates on their 7- and 8-based systems, which also disables important patches that can prevent new malware: people are sacrificing a lot to avoid Windows 10, and Microsoft is rightly being criticised for how heavy-handed the rollouts has become.

And one of China's biggest tech advocates, at least, isn't having a bar of it. According to a legal adviser to the Internet Society of China, via official Chinese news agency Xinhua, Microsoft is emphatically in the wrong. "The company has abused its dominant market position and broken the market order for fair play," adviser Zhao Zhanling said.

Nowadays, the prompt to update to Windows 10 has made it difficult to find a way to decline, and ignoring it will reportedly just cause the update to trigger automatically. More gallingly, simply closing the update window will schedule an update, rather than deny one. That strategy is ominously similar to that used by viruses, and, if you don't want Windows 10 but it's installing anyway, Windows 10 could (at the very least) be classed as malicious software.

However, Never10 (www.grc.com/never10.htm) is a tool from well-known security researcher and commentator Steve Gibson, and it's apparently capable of removing any chance of an update. If you decide that you do want to update to Windows 10 (ie. when Microsoft finally releases a proper *Halo* on the Windows Store), you can easily switch it back off. That should put your mind at ease while you dig your heels comfortably into the past. ■

ENDUSER

Share your stories!

If you have an interesting story about technology users, their experiences and the issues that affect us all (whether funny or serious), email us at apcmag@futurenet.com. All correspondence becomes the property of APC and is subject to editing. Letters must include writer's full name, street address, suburb, state and phone number to be considered for print publication. Address and phone details will not be published.

technotes

INSIDE APC



Inside APC

Find out all about APC's editorial policies, test practices, how to read the benchmark results and more.

APC is Australia's oldest consumer technology magazine – having been consistently in print for over 35 years, since our first issue way back in May 1980 – and we take that heritage and responsibility very seriously. While our focus is obviously on the personal computer – it's in our name, after all – the very definition of the PC has changed and shifted markedly since the early 1980s. As such, we touch on many other areas of tech too, from smartphones and apps to peripherals, accessories, online services and beyond. We have two main goals: to track down the best of modern tech and also to help our readers make the most of it.

We're also an open church in terms of platforms. We know most people aren't wed to a single brand's products and use a variety of devices. And like you, APC's journalists want to know what's good in tech – no matter what platform it resides on.

INDEPENDENT REVIEWS

Championing technology doesn't mean we're unrelenting yes-men, however, and APC aims to be as objective as possible in all our coverage. That means identifying the best products from multiple perspectives – the best performance, best value and best features and, ideally, the products that offer the best mix of these three.

As a matter of policy, reviews published in APC are not shared with product-makers prior to print. We will contact vendors under certain conditions; for example, if we have a problem testing a product that seems to indicate it may be faulty, or to invite a vendor to clarify how a particular feature works. If an APC reviewer has any potential conflicts of interest involving a brand, the review will always be assigned to another writer.

LABS TESTING

Despite being a small magazine with limited resources, APC still strives to conduct the most rigorous, objective scientific tests and benchmarks we can so as to make our reviews as unbiased as possible. We use a variety of tools and programs for this, including many freely available benchmark suites for assessing media encoding, general system performance, gaming and battery life.

In most cases, for the benchmark results published in APC, you can assume that higher is better. There are certain tests that deviate from this rule and where the opposite is true; in those cases, we've flagged the results with a note explaining as such.

We use both tables and graphs for displaying results; the latter are our preference due to their ease-of-readability, but tables are more compact, so we use these in cases where thoroughness is preferred.



ASUS NINJA WATER-COOLED PC

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PRICE: \$3,099

WEB: www.asuspromotion.net/au/watercoolingpc/

SPECIFICATIONS:

CPU: Intel Core i5-6400

GPU: ASUS STRIX-GTX970-DC20C-4GD5

MB: ASUS B150 Pro Gaming Aura

RAM: 8GB Kingston HyperX Fury

SSD: Kingston HyperX Predator 240GB M.2

HDD: 1TB HDD

WATER COOLER: Custom Bitspower setup

PSU: In Win 900W

CASE: In Win 805

BENCHMARKS:

GRID 2 AVG FPS @ 1080P	133.7
CRYSTALDISKMARK 3.0B AVG READ/WRITE (MB/S)	1501/788
X264 VIDEO ENCODING PASS 1/PASS 2 AVG FPS	39/11.6
3DMARK FIRESTRIKE EXTREME	4875



INTRODUCING POWERED BY ASUS WATER-COOLED PCs

PC-HARDWARE POWERHOUSE ASUS IS INTRODUCING A NEW SERIES OF GAMING PCs TO THE AUSTRALIAN MARKET, WHICH COME EQUIPPED WITH ENTHUSIAST-GRADE CUSTOM WATER-COOLING RIGHT OUT OF THE BOX.

AIMED AT USERS LOOKING FOR THE BEST bang-for-buck, the Ninja is the most-affordable of ASUS's new water-cooling range and it aims to give buyers excellent day-to-day gaming performance combined with an eye-catching build. It's been specifically designed by ASUS's own water-cooling experts and it's available through selected Aussie system builders right now.

At the Ninja's heart is an Intel Core i5-6400 CPU — a quad-core Skylake chip that normally hums along quietly at 2.7GHz, but can boost up to 3.3GHz. Graphics grunt is handled by an ASUS STRIX GeForce GTX 970, which comes factory overclocked. The Ninja runs 8GB of Kingston HyperX Fury 2133MHz C14 DDR4 RAM, configured as two 4GB chips. Storage is handled by a hybrid setup, with a super-fast Kingston HyperX Predator M.2 SSD as the primary drive, and a secondary 1TB HDD for extra space. The whole shebang is powered by an In Win 900W PSU, and sits in an ASUS B150 Pro Gaming Aura motherboard.

To keep it all cool, the system features a

custom-built Bitspower water-cooling system feeding into a large front-mounted radiator. It's not just for the CPU either, with a water block added to the video card, and all using quality rigid tubing and compression fittings. When the system is purchased from an ASUS Water Cooling Certified reseller, it comes with full warranty support on the GPU, despite the fact that its original air-cooling system has been removed — a step that would normally void the ASUS warranty.

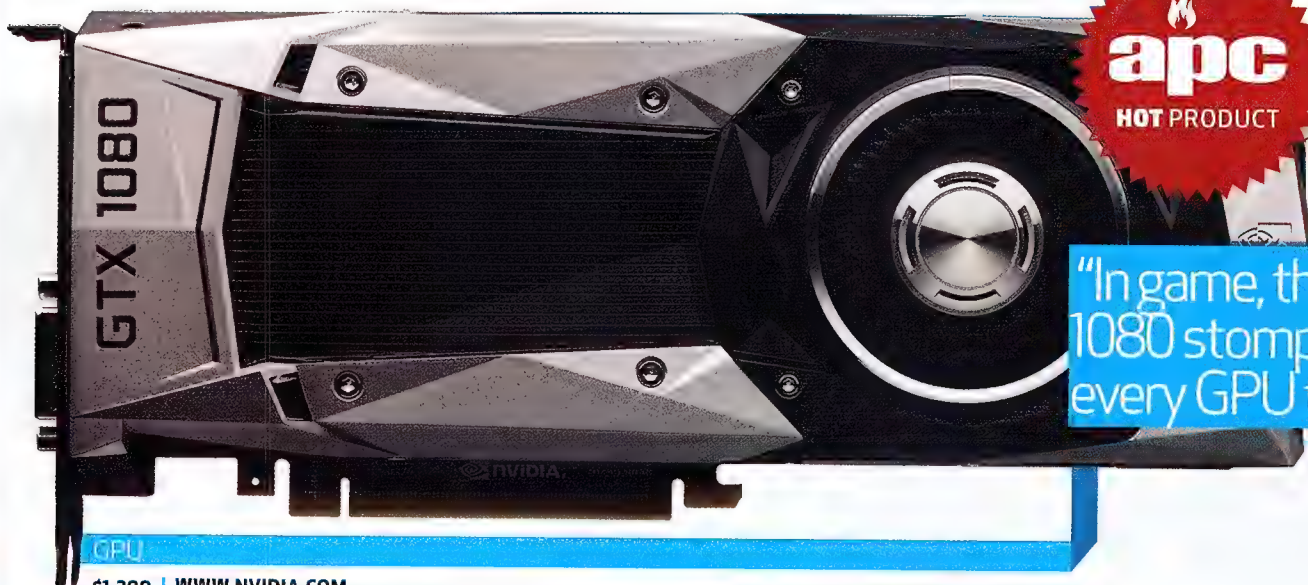
Thanks to that B150 Pro Gaming Aura motherboard, the Ninja has plenty of connectivity options, not to mention funky LED lighting built in. Round the back you get 4 x USB 3.0 ports (as well as 2 x USB 2.0), dual USB 3.1 (one Type-C, one Type-A), plus Gigabit Ethernet, PS/2, VGA and HDMI ports. The board uses ASUS SupremeFX audio that gives 5 x 3.5mm outputs, as well as S/PDIF output. The audio is based on the Realtek ALC1150 codec, and no surprise, the sound quality is top notch.

The end result is a powerful PC which can happily handle the latest games at 1080p with

the highest detail settings, and it also manages to remain pretty quiet under full load thanks to that custom water-cooling setup. Of course if you want to go beyond 1080p gaming, or have a high-framerate gaming monitor, then it's worth looking at one of the Ninja's higher-spec siblings.

All that custom hardware is contained in an In Win 805 case — a great looking, sharply-angular chassis that's clad in tempered glass and available in either black or red. The build-quality and attention to detail are both excellent, with neatly routed cables, unimpeded airflow and a simplified, free-flowing water-cooling design. There's also plenty of space for future expansion if you want to add more PCIe devices, extra drives, or just more stylish bling.

Even though it's on the more affordable end of the scale, the Ninja is still a confident gaming machine — and one that'll certainly turn heads next time you're at a LAN. And for anyone with a slightly different spec in mind, the system can be further customised to suit your individual needs.



\$1,299 | WWW.NVIDIA.COM

Nvidia GeForce GTX 1080

All hail Pascal, the new king!

Ladies and gents, Pascal has landed. The 16nm FinFET hero has finally arrived. It's the first in a new lineup of graphics processors that transcend the charms of the ultimately limited 28nm manufacturing process. And, today, we can confirm exactly what this little beauty holds within, and what the GTX 1080 means for Nvidia's next generation of bunker-busting GPUs.

So, what are we talking? 2,560 CUDA cores, 160 texture units, 64 ROPs, 9 TFLOPS of performance, a stock boost clock running at 1,733MHz, and 8GB of GDDR5X VRAM running at a solid 10,000MHz on a 256-bit memory bus. Glamorous, eh? What does that mean for the uninitiated? Think of it this way: A Titan X is capable of producing 7 TFLOPS, a GTX 980 Ti 6.5 and the now-lowly 980 can just about pump out 5.3. So spec for spec, the new GTX 1080 should slay its predecessor twice over.

Criticisms? Firstly, the GTX 1080 doesn't harbour

the big Pascal GP100 core architecture found in Nvidia's high-end Tesla P100 graphics cards, announced earlier this year. No, this is GP104, akin to a scaled-down variant of Maxwell. But that's by no means a bad thing – Maxwell has incredible overclocking potential. On top of that, we've yet to see any hint of HBM 2.0; although we're expecting to see mainstream production roll out this year, it's likely we won't see a new generation of Titan or Ti field this bandwidth-munching monster until nearer summer.

That's not to say the 1080 lacks memory power. In fact, this is the first GPU to feature Micron's GDDR5X standard. Packing higher frequencies, higher capacity per chip, and better power efficiency, the 1080 has 8GB of 10,000MHz on a 256-bit memory bus, enabling a max bandwidth of 320GB/s. But enough specs, how does it perform?

As far as the thermals and power draw go, this is interesting. Overall, the

GTX 1080 has a higher TDP than the 980, coming in at 180W, as opposed to 165W. However, temperatures are still quite low, with the card ramping up to 82°C with GPU boost. Of course, you can increase that limit to 91°C, similar to last-gen. What is notable is the cooling system. The single blower fan on the 1080 spins at a far lower rpm than the 980, so temperatures tend to ramp up higher before the fan kicks in, no doubt to save our ears from unnecessary noise.

In game, the GTX 1080 stomps on every GPU to date. Short of SLI/CrossFire configurations, and multi-GPU cards such as AMD's Radeon Pro Duo, there isn't much in the way of competition. It makes 4K gaming accessible. By no means is it a flawless 60fps experience in AAA titles, but we're almost there. Drop the unnecessary AA from our benchmarks at 4K (thanks, pixel density), and you can easily hit a 60fps average.

That said, in *Far Cry Primal*, *The Division*, and *Ashes of the Singularity*,

average frame rates were into the forties, with minimum frames not dropping below 20. At 1080p, it wasn't uncommon to see minimum rates in the 80s.

Our biggest gripe is with the price. For this particular card, the Founder's Edition, you have to fork out at least an additional \$200. For the extra moolah, you net yourself a pretty box, the signature metallic shroud, and access to the 16nm GPU two weeks earlier than the AIB cards. The core is incredible, performance exceptional, but the pricing scheme just ludicrous.

■ Zak Storey

Verdict

Features ★★★★★
Performance ★★★★★
Value ★★★★★

Exceptional performance and overclock potential from a single GPU, but early pricing is ridiculous. Wait a month or two.

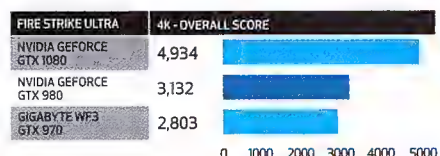
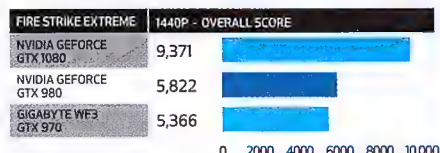
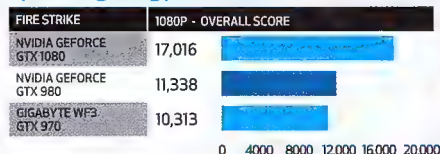




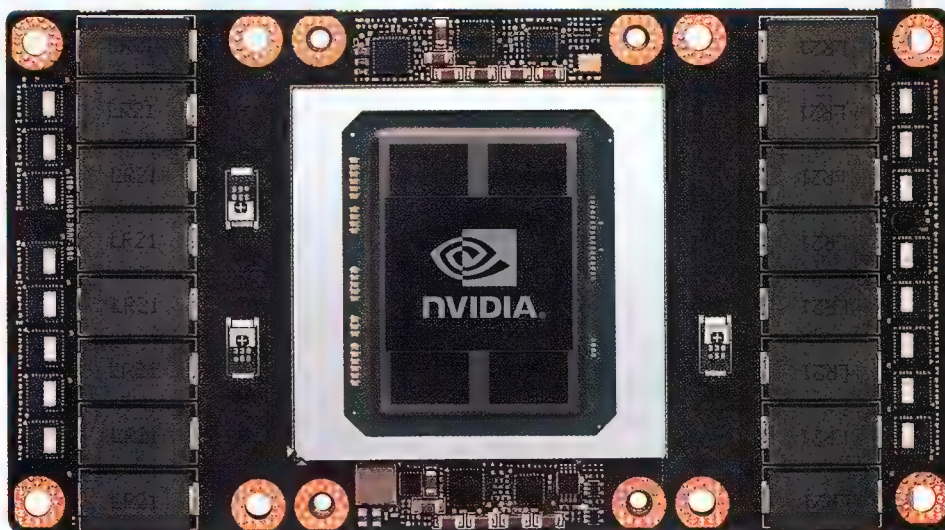
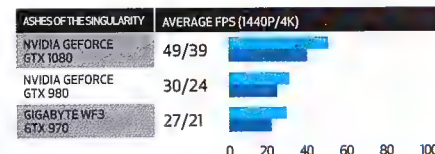
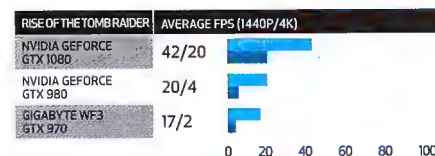
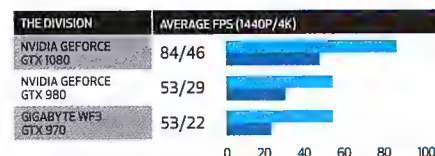
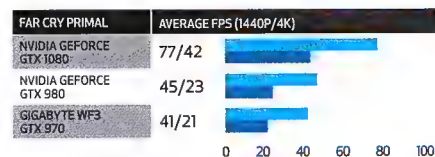
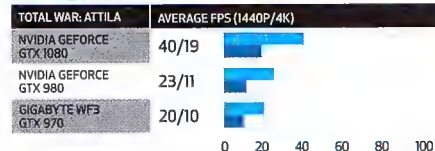
LABS BENCHMARK RESULTS

Game results are average fps at 1440p/4K. Our test bed consists of a Core i7-6700K, 16GB of Kingston Savage DDR4 @ 2400 MT/s, and an MSI Z170A Gaming M7.

Synthetic gaming performance



Gaming performance



What's better than GP104? Try the GP100.

"The GTX 1080 is a beast that has devoured all contenders — just look at the bones! But while we're suitably impressed, this is definitely not the biggest GPU that Nvidia could make."

Pascal isn't done, not by a long shot

The GTX 1080 is awesome, but Nvidia is holding back.

We've known about Pascal for what seems like ages, and after five years of 28nm, GPUs finally have a new process node. The GTX 1070 should be widely available by the time you read this, and both it and the GTX 1080 use the company's GP104 architecture. The GTX 1080 is a beast that has devoured all contenders — just look at the bones! But while we're suitably impressed, this is definitely not the biggest GPU that Nvidia could make.

That title currently goes to GP100, which is available in the Tesla P100. Except it's not really available as a stand-alone card; if you want GP100, you'll have to buy one of Nvidia's US\$129,000 DGX-1 servers. At least that will net you eight Tesla P100s, which means they're around US\$12,500 a pop.

As fast as GTX 1080 is, all you have to do is look at some of the specs of GP100 to guess where Nvidia will go next. GP104 has 7.2 billion transistors, a step down from the 8 billion transistors in the Titan X's GM200, but 16nm FinFET has brought higher clocks, a smaller chip, and lower prices. GP100, in contrast, goes big, with 15.3 billion transistors and a 610mm² die that's nearly twice the size of the GP104. It also packs 16GB of HBM2 memory, capable of 720GB/s, and FP64 runs at half the rate of FP32 (compared to 1/32 on GP104).

Will we see GP100 in a Titan or 1080 Ti card in the future? Perhaps. Or Nvidia could do a consumer card without the FP64 and HBM, but with more FP32 cores and 12GB GDDR5X memory. Whatever the company builds, though, it will certainly trounce our current darling, the GTX 1080.

Jarred Walton



ULTRABOOK

FROM \$1,549 | WWW.RAZERZONE.COM

Razer Blade Stealth

Put away the control pad, this one's been made for professionals.

Unlike Razer's other laptops, the Razer Blade Stealth isn't really a device for gaming – it's only got a basic Intel HD 520 GPU, which is a far cry short of the performance you'll see from an Nvidia or AMD mobile gaming part. Instead, the US company is aiming for a broader audience with this sleek and light ultrabook – and it's hoping it'll have mass appeal thanks to a very low starting price. Locally, you can only order one of these directly from Razer's own site – the company says it's cutting out the middle-man so it can offer the lowest prices possible.

In the flesh, what's apparent right from the outset is that the overall build quality is first-rate: this is a slick and solid laptop with a gorgeous keyboard and trackpad, outstanding high-res screen and low 1.25kg carry weight. The included charger is also very light and compact, so

it's not a chore to cart it around if needed, and Razer hasn't overloaded the system with crapware – in fact, the only thing that could perhaps be considered superfluous is Razer's own Synapse driver software.

Razer's made some interesting choices, like implanting a Core i7-6500U processor in every unit (it's one of Intel's lower-power CPUs, so it's still only a dual-core chip) and 8GB of memory with a 12.5-inch QHD (2,560 x 1,440-pixel) IGZO touchscreen display. Those relatively high-end parts make \$1,549 seem like a steal.

It largely delivers on that on-paper appeal too: the IGZO display offers 100% RGB colour coverage and is almost obscenely, the keyboard keys have a great balance between resistance and throw-length and the trackpad is one of the most responsive and consistent of all the Windows laptops we've tested. We had zero issues with multi-finger

scrolling and other actions that can often trip-up trackpads on Windows.

And if you do want to add gaming, Razer has an upcoming accessory called the Core, an external graphics card enclosure that lets you install your own card of choice and then plug it into a compatible laptop (or even desktop) via Thunderbolt 3 – not just Razer hardware. There's no word yet on local pricing, but in the States it's set to sell for US\$499, so expect something around the AU\$800 mark.

There are some shortcomings to the Blade Stealth, however, like a battery that lasts about three-and-a-quarter hours. While that isn't bad given the high-end components and slim profile, it certainly cuts into this one's appeal as a portable all-day device.

That IGZO display has a wide bezel around it too – it's big enough that it feels like Razer could have easily squeezed a 13.3-inch display

in here, a screen size that would offer a bit more versatility and headroom.

Our test unit emitted some coil noise from the charger – a whine that would have been enough for us to return the unit, had we purchased it ourselves – and it's a problem others have been complaining about on Razer's forums.

At this price and with this build quality, we're willing to let some things slide, however, and if you want the thinnest and lightest unibody Windows ultrabook, the Razer Blade Stealth is hard to pass up.

■ Dan Gardiner

Verdict

Features
Performance
Value



Great hardware at a very keen price, but battery life could be better and a 13-inch display would've been nice.





\$4,299 (\$3,199 DIY) | WWW.ASUSPROMOTION.NET/AU/WATERCOOLINGPC

ASUS Samurai Water-Cooled PC

Custom-cooled and overclocked for premium gaming performance

For those craving higher-end gaming performance, the Samurai is ASUS's mid-range option in its new custom water cooled line and comes overclocked out of the box. Our test machine was built by ASUS, but you can get the same machine (or one customised to your spec) from a range of certified resellers. The Samurai uses the capable ASUS Z170 Pro Gaming, nestled inside the rather roomy In Win 909 case. Almost completely clad in tempered glass, it's a beefy, hard to move fingerprint magnet, but it does do a fantastic job of showing off the custom hardware.

The buzzing robotic heart of the system is an Intel Core i5-6600K CPU that normally boosts from 3.5GHz up to 3.9GHz. To squeeze out extra performance, the processor has been overclocked all the way up to 4.5GHz, and then stability tested. Gaming

capabilities are provided by an ASUS STRIX GeForce GTX 980, which also comes factory overclocked. To avoid a meltdown, the Samurai has a totally custom Bitspower water cooling system. Both the processor and graphics card get a cooling block, with a large rear-mounted radiator dumping the excess heat outside the case. The high-end cooling array is somewhat overkill considering the system spec, but it does look great, and provides a little extra headroom to squeeze even more performance from the system without overheating.

The Samurai has 16GB of HyperX Savage RAM (dual 8GB DIMMs) running at 2666MHz with CL13 timings. Ultra-fast storage is handled by a 240GB HyperX Predator M.2 SSD, and there's a secondary 2TB HDD for general storage.

We put the Samurai through a range of tests, from CPU through to GPU

intensive tasks. The system performed very well, and is more than capable of handling modern games with all the details cranked to maximum. It'll happily handle many titles at above 1080p, but some may need the detail levels pulled back a little. Under a heavy gaming load, the Samurai is quite audible, but under normal conditions it's barely above the ambient background noise.

The In Win case looks great, but in some respects is a weak point of the system. It's pricey in itself, and while the middle of the case mounting system is great for cooling options, accessing the rear ports on a motherboard can be tricky. Just getting set up requires removing the side panel, and even then the access is restricted by the water cooling and cabling.

The ASUS Z170 Pro Gaming includes all the features you might expect,

such as Gigabit Ethernet, SupremeFX audio and even USB Type-C. The back panel also has another four USB 3.0 connections, dual USB 2.0, PS/2, USB 3.1, 5x 3.5mm audio jacks and S/PDIF.

The Samurai is a tricky beast to assess objectively, as it's a system aimed at users who want a unique look and build, not just performance innards. You can get all these parts and build on yourself for less, but for those who don't have high-end DIY skills, the Samurai is tested, overclocked, and ready to go.

■ Lindsay Handmer

LABS BENCHMARK RESULTS

General performance

GRID 2	AVERAGE FPS
ASUS NINJA	133.7
ASUS SAMURAI	201.69
ASUS SENSEI	241.25

CRYSTALDISKMARK 3.0B	AVERAGE READ (MB/S)
ASUS NINJA	1501
ASUS SAMURAI	1489
ASUS SENSEI	1564

CRYSTALDISKMARK 3.0B	AVERAGE WRITE (MB/S)
ASUS NINJA	788
ASUS SAMURAI	812
ASUS SENSEI	847

X264 VIDEO ENCODING	PASS1
ASUS NINJA	39
ASUS SAMURAI	51.20
ASUS SENSEI	91.69

X264 VIDEO ENCODING	PASS2
ASUS NINJA	11.6
ASUS SAMURAI	16.45
ASUS SENSEI	24.12

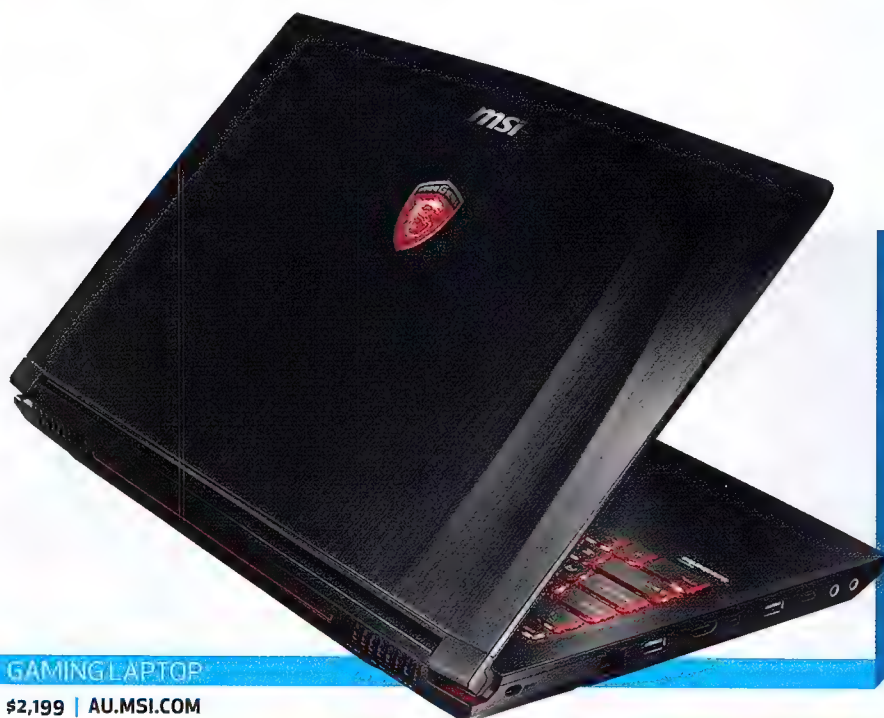
3DMARK	FIRESTRIKE EXTREME
ASUS NINJA	4875
ASUS SAMURAI	6126
ASUS SENSEI	9289

Verdict

Features ★★★★★
Performance ★★★★★
Value ★★★★★

A capable custom-built gaming PC that doesn't sacrifice style.





GAMING LAPTOP

\$2,199 | AU.MSI.COM

MSI GE62 Apache Pro

The laptop equivalent of a sporty 4WD.

MSI's GE62 6QF-030AU aims to be an everyman gaming notebook. It's not too big to carry around, but it's still big enough that you won't end up squinting at the screen when using the native 1080p resolution. Performance is good, with a GTX 970M being a nice fit for 1080p gaming, and that in turn helps to keep the price from climbing too high. But rest assured, the GE62 isn't a weak budget offering.

You get a full keyboard with dedicated 10-key, multicoloured backlighting, multiple video ports, and high-speed connectivity from Killer Networking. Throw in an IPS display, and there's lots to like—there's even an M.2 PCIe x4 Gen3 slot with NVMe support. Unfortunately, the M.2 slot was occupied by a mediocre M.2 SATA drive from Toshiba. There's also no Thunderbolt 3 or G-Sync support, the latter being

mutually exclusive with dynamic switchable graphics, which the GE62 supports.

Think of the GE62 as something of an affordable sports car, and you're not far from the truth. It's never going to take down a Ferrari or Hellcat, but it's got plenty of pep. Compared to a 2-year-old gaming laptop, the i7-6700HQ CPU here has only improved performance around 5–15%, but graphics speed is a gigantic leap forward, blasting through games at roughly 2.5 times the performance of the aging GTX 765M. Unfortunately, battery life also takes a hit, ultimately falling short of 3 hours of video playback, though in lighter use (surfing the net, for example), you can hit around 5 hours.

Overall, the GE62 performs admirably, particularly when it comes to gaming—in our extended online test suite, it averaged 114fps at 1080p Medium, and 43fps at 1080p Ultra.

With such a great foundation, the storage configuration still leaves us flummoxed. We haven't used DVDs or Blu-rays for years, but the GE62 still includes an optical DVD-RW drive—great if you need it; wasted space if you don't. Supporting NVMe but shipping without an SSD drive—only a 1TB mechanical HDD—is even more perplexing. Give us a 256GB or 512GB 2.5-inch SSD (leaving the M.2 slot open for future expansion), even if it costs extra. Frankly, using a mechanical drive for the OS doesn't cut it in a modern laptop aimed at performance. Sure, you can upgrade later, but we'd rather get a good SSD from the start.

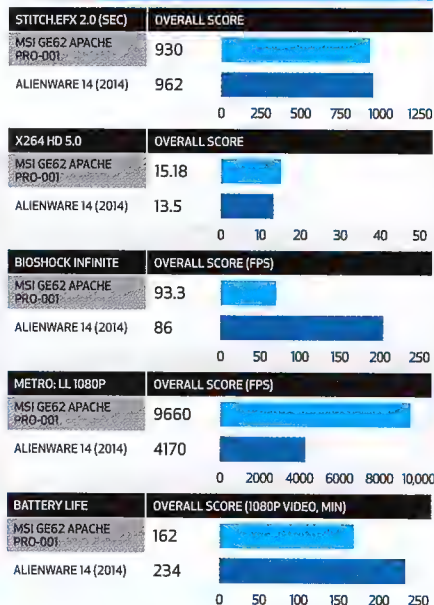
But despite a few oddities in the storage department, overall there's plenty to like. The GE62 runs as fast as everything else using the GTX 970M, and it does it in a package that weighs and costs about half as much as the extreme GTX 980

notebooks. There are much faster laptops, and there are thinner and lighter gaming notebooks as well. However, thin plus gaming often equals hot and noisy—the laws of thermodynamics are a harsh mistress—and the GE62 strikes for more of a middle ground.

If you're looking for a gaming notebook that functions as a jack-of-all-trades, the GE62 Apache Pro hits most of the right notes. Just don't be surprised when the inevitable update comes along with a new GPU that uses less power and runs faster.

■ Jarred Walton

LABS BENCHMARK RESULTS



Verdict

Features
Performance
Value



Good 1080p gaming in a reasonably portable and balanced system, but the lack of an SSD is a sore spot.





DESKTOP GAMING PC

\$5,399 (\$4,099 DIY) | WWW.ASUSPROMOTION.NET/AU/WATERCOOLINGPC

ASUS Sensei Water-Cooled PC

Designed and built for desktop gaming at the top level.

The Sensei is the third and fastest option in ASUS's new Water Cooled line and it knocks the frame rates up another notch thanks to higher-end core components – although the water cooling is essentially the same as the Ninja and Samurai.

The basis for the Sensei build is the ASUS ROG Maximus VIII Hero Alpha squeezed inside the stylish, tempered-glass clad In Win 909 case. Sitting pretty under a Bitpower water block is the top shelf Intel Core i7-6700K – a 4GHz quad-core part that boosts to 4.2GHz. Of course, stock performance is not the name of the game, so the processor has been pushed all the way up to 4.8GHz. Importantly, the configuration has been fully tested by ASUS's engineers (and the BIOS settings provided to system builders), to ensure a stable and reliable PC that can be

run 24/7. Graphics get the same treatment, with a blazing-fast ASUS STRIX GeForce GTX 980 Ti with the stock heatsink removed in favour of another Bitpower water block. The cooling system's constructed from rigid acrylic tubing, routed to avoid unnecessary bends, and feeding into a large rear-mounted 360mm radiator. The end result is a powerful gaming PC that stays cool and (relatively) quiet under load, whilst also looking great. The Sensei includes a huge 32GB of Kingston HyperX Savage 3000MHz CL15 DDR4 RAM, installed as 4 x 8GB DIMMS. For storage, the system has a Kingston M.2 HyperX SSD as the high speed OS drive, and a 3TB HDD for extra space.

No surprises in testing – the Sensei can power 1080p gaming without batting an eye, and has the grunt to drive modern titles at higher resolutions up to and beyond 1440p.

Depending on the game, the Sensi's powerful enough to crank decent framerates in 4K, but if that is the aim, consider an upgrade of another GPU in SLI. For those who like to LAN, be warned that the Sensei is a heavy machine, which makes it a bit of a chore to set up and pack away.

Thanks to the ASUS ROG Maximus VIII Hero Alpha motherboard, the Sensei is chock a block full of internal and external connectivity options. Annoyingly though, the water-cooling hardware can restrict access to the rear ports, and the cable routing in the area could perhaps be better. The PC has 2x2 802.11ac MU-MIMO Wi-Fi (with antenna), which provides a solid enough connection for low ping gaming, as well as copying large files or streaming media. Internally it has dual U.2 sockets, M.2 (in use), 6 x SATA 6Gbps connections, as well as six of both USB 3.0

and 2.0 via headers. Round the back the system has 2 x USB 2.0, 2 x USB 3.0, and both Type-A and Type-C USB 3.1 for super-fast transfers. It also has SupremeFX audio, with 5 x 3.5mm audio jacks, and S/PDIF output.

While the Sensei does command a price premium that does reflect the extra effort that's gone into testing and building a high-spec yet reliable gaming machine. For those who want peace of mind and a blazing fast, custom-cooled overclocked system, that's a worthy trade off. ■ Lindsay Handmer

LABS BENCHMARK RESULTS

General performance

GRID 2	AVERAGE FPS
ASUS NINJA	133.7
ASUS SAMURAI	201.69
ASUS SENSEI	241.25

CRYSTALDISKMARK 3.0B	AVERAGE READ (MB/S)
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CRYSTALDISKMARK 3.0B	AVERAGE WRITE (MB/S)
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X264 VIDEO ENCODING	PASS2
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ASUS SAMURAI	16.45
ASUS SENSEI	24.12

3DMARK	FIRESTRIKE EXTREME
ASUS NINJA	4875
ASUS SAMURAI	6126
ASUS SENSEI	9289

Verdict

Features
Performance
Value



A high end gaming machine with a custom water cooling system and an extreme overclock that remains reliable.





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INTEL CPU

\$2,579 | WWW.INTEL.COM.AU

Intel Core i7-6950X

The world's first consumer deca-core processor. Now, who's paying?

This is the biggy. The very latest word in ultra-enthusiast desktop processing – the 10-core Intel Core i7-6950X. And what a beastly slice of silicon it is.

The 6950X is the pinnacle of the high-end tick of Intel's 'tick-tock' cycle, taking the existing Haswell core architecture, and shrinking down the smallest transistors to a freakishly tiny 14nm lithography. Because it's just an Intel tick, though, little else has fundamentally changed between this and the previous HEDT chip, the Core i7-5960X.

There's the same 140W TDP, the same 40 PCIe 3.0 lanes, and the same 3GHz/3.5GHz base/Turbo clock speeds. You do get a slight revision in the Turbo Boost technology, and the base DDR4 memory support has been upped from 2,133MHz to 2,400MHz, but that's pretty much it. OK, yes, elephant acknowledged – there's also another two cores jammed in.

Intel isn't just throwing those extra two cores into the new generation of processors for free, as it did from the six cores of Ivy Bridge-E's i7-4960X to the eight of Haswell-E's i7-5960X. This isn't a direct successor to the previous generation's top processor; this chip sits outside of even those upper echelons of unaffordable silicon.

The actual successor to the Core i7-5960X (Haswell-E) is the tantalizing Core i7-6900K, an eight-core, \$1,650 CPU with the same spec as the top Haswell-E chip, but with a 3.2GHz base clock and a 3.7GHz Turbo clock. We're holding out hope that's the king overclocker of the range. But let's forget the outrageous cost for a second and consider performance – in that, the 6950X is unsurpassed. In multi-threaded tasks, it slices through all that's put in front of it with ease. With Cinebench R15 and the x264 encoding test, the Broadwell-E chip is well out in front of the best that

Haswell-E could offer. It's not just by virtue of those extra cores either, which bodes well for both the 6900K and 6800K – the single-core performance of the 6950X has improved, too. There's still a SpeedStep issue with the ASUS board we used for testing, which afflicted the Haswell-E chips, too, but with that turned off, you get the same improved single-core performance the Core i7-5775C (desktop Broadwell) exhibited.

That boosts the gaming performance, too, despite the Broadwell-E chip not Turbo-ing as high as its older sibling. The 6950X sticks around 3.4GHz for the most part, while the 5960X at stock speeds will consistently Turbo at 3.5GHz. In our initial testing, it missed the overclocking mark by 100MHz, with the latest chip topping out at 4.3GHz, while our 5960X happily hit 4.4GHz. That said, the 6950X did deliver an astounding score of 2,220 in Cinebench.

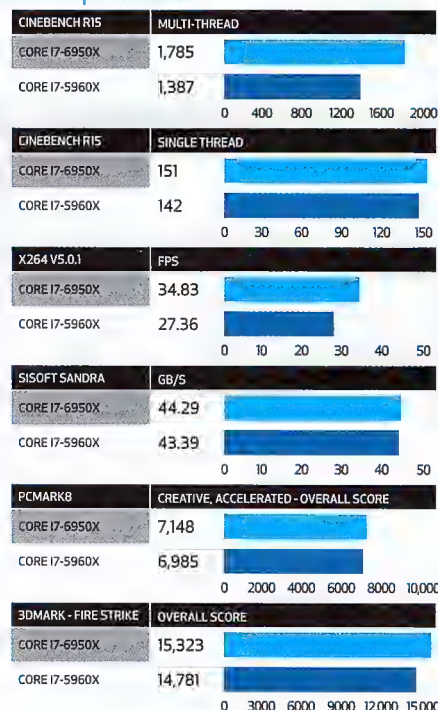
As expected, then, the 6950X is the very best in consumer processing, and will devour multi-threaded tasks. But, it's prohibitively priced, sits aside from the real meat of the Broadwell-E range, and almost only serves to demonstrate the engineering might of Intel's 14nm process by delivering the desktop its first deca-core CPU. And while it has pushed the six-core chips into a more affordable price point, it hasn't managed to do the same for the static eight-core. It's a halo product – a technological wonder, rather than anything we would honestly buy.

■ Dave James

LABS BENCHMARK RESULTS

Tested with ASUS X99 Deluxe, Corsair H100i, Nvidia GeForce GTX Titan X, 16GB DDR4 @ 2,133MHz, 512GB Samsung 850 Pro, BeQuiet 1,000W PSU

General performance



Verdict

Features
Performance
Value



Ten bleedin' cores; stunning multi-threaded performance; improved single-core prowess; too expensive.





INTEL MOTHERBOARD
\$519 | WWW.ASUS.COM/AU

ASUS X99-A II

A beautiful and necessary refresh.

Broadwell-E is here. The Core i7-6950X has landed in all its deca-cored glory (see page 28), yet there are a few other processors in that wicked lineup of 14nm number-crunchers such as the notable i7-6800K. That six-cored, 12-thread processor makes X99 and HEDT systems more accessible to the masses than ever before. But what do you couple with a CPU like that?

How about the ASUS X99-A II, a revision of ASUS's entry-level X99 signature series motherboard? There are several differences between the original X99-A and this Broadwellian incarnation: new rear I/O cover and VRM heatsink design; advanced RGB LED lighting included along the top of the board, and on the PCIe slots; better fan control technology, including Q-Fan 4; a reinforced PCIe slot; electrostatic discharge protection for your RJ45

Ethernet; an additional 4-pin EPS power, to help balance out processor voltage load; and the addition of a U.2 connector, located just south of the SATA connectors.

As far as design goes, ASUS has really nailed it when it comes to glitzing up one of the historically more dull components in your system. The rear I/O cover is a nice touch, and the clean style and reinvigorated heatsinks, pulled across from its Skylake signature series, work wonders on this entry-level HEDT mobo.

So, does it perform? By default, all ASUS boards – certainly Skylake onward – have an included ASUS Optimized CPU Ratio setting automatically enabled in the AI Tweaker section, buried deep within the BIOS. For those running purely vanilla chips, sans any BIOS tomfoolery, this tends to bump up the frequency by around 0.2GHz, meaning that, at stock, benchmark scores

tend to be higher than those of competing motherboard manufacturers. However, keeping this enabled during overclocking quite dramatically reduces the overall performance output at higher voltages and frequencies.

As far as overclocking goes, the extra pins ASUS has included within the socket are meant to help retain a more precise CPU VCore voltage during overclocking, meaning a more stable overclock overall. In our testing, we found this to absolutely be the case. Setting our VCore way up to 1.35V, and then running Cinebench as our load test, saw absolutely no drop or random variances at all, regardless of Vdrop.

Amazingly, we managed to get our trusty Core i7-5820K to clock up to an astounding 4.5GHz, and have it remain completely stable on only 1.375V. All in all, it's a sound update to the everyman's motherboard. That said, it's not without its

flaws. Installing it into our mid-tower chassis was a nightmare – thanks to the CPU EPS power being top and center of the X99-A II, it meant we had to do some ingenious pre-planning, just to get all the fan cables plugged in without a hitch. Although this placement is common in many of the high-end boards the accessibility of the Core i7-6800K, coupled with the pricing and feature set of the X99-A II, is going to cause problems for those not willing to part with their otherwise midi-sized chassis.

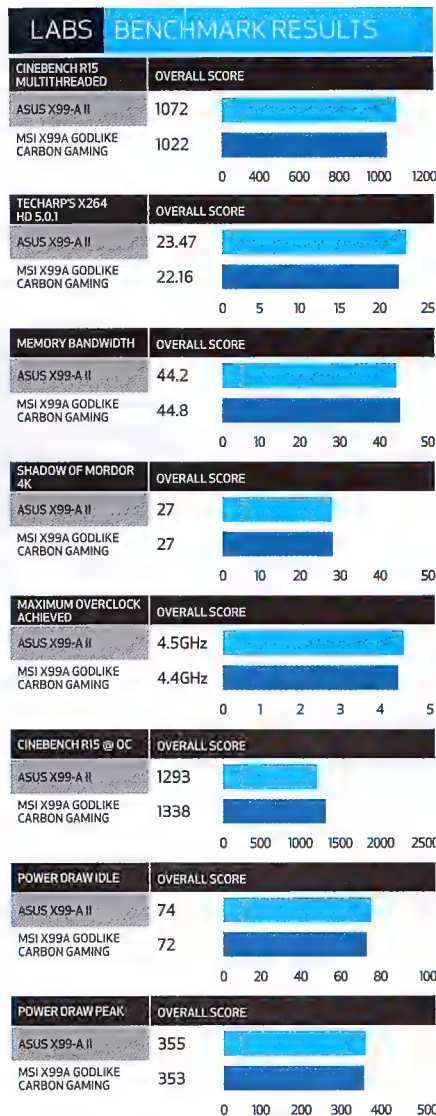
■ Zak Storey

Verdict

Features ★★★★★
Performance ★★★★★
Value ★★★★★

Expandable; solid feature set; great upgrade over X99-A; subtle lighting. Awful location of CPU header.

★★★★★





27-INCH MONITOR

\$399 | WWW.PHILLIPS.COM/MONITORS

Philips 276E6ADSS

Is quantum dot colour tech as cool as it sounds?

Most monitors produce colour that almost anyone would be happy with, but if you're serious about your Photoshop work, video editing, page layout or any other media design creation, you shouldn't settle for average. Philips says this new 27-inch display in its E-Line range reproduces '99% of Adobe RGB', the colour space that's relied on by media pros.

This focus on colour reproduction means it doesn't have any extra features; there are no pass-through USB ports or built-in speakers, but it does have a pass-through audio jack if you connect using HDMI. It's a moderately elegant-looking device, with a white bezel around the 27-inch LCD panel, and rests on a slim curved aluminium base. There's 25-degree range of tilt, although only five of those are leaning back from vertical. The

specs state a viewing range of 178 degrees both vertically and horizontally; in other words, what's on the screen looks the same until you're so nearly edge-on that it's pointless.

Philips says this is the first monitor with quantum dot colour technology, using nanomaterial that produces more precise colour control. That 'quantum dot colour technology' is, at heart, LCD tech, but changes the way it displays colours by using blue light. The quantum dots themselves are tiny crystals – think smaller than the width of a human hair – that react to light, and have a long shelf life. In fact, they won't change or distort over the course of their lifetime, making them very appealing if you want a screen with longevity.

That '99% Adobe RGB' claim is a bold one; there are monitors that do achieve this, but the vast majority resolve the colour range of the more basic sRGB. We tested the display with

Datacolor's SpyderElite and found that our model achieved 98% of Adobe RGB – a negligible variance.

But it isn't all roses. The gloss-white plastic casing looks good, but it's rather thin and prone to bending if you grip the top or the sides. It also creaks and pulls slightly away from the actual LCD panel when you tilt it forward or back, somewhat undermining the display's credentials as a high-quality device. It's also only a 1080p display, and considering the inevitable creep towards 4K, it's a little disappointing that it isn't pulling put 1440p.

The buttons for power, displaying on-screen controls and configuring them are touch-sensitive spots underneath the screen's front edge. There's absolutely no tactile element here, so you'll have to look very carefully to be sure you tap the right part of smooth plastic.

So what you have is a very high-quality LCD panel that

achieves almost 100% Adobe RGB colour rendering, better than almost anything in its class. The image quality is not matched by the build, though; the case is thin and flexible, and the on-screen display controls are awkward.

So what to do? Well, if you want a screen purely for gaming, look elsewhere. This isn't responsive enough for the asking price, but for professional photographers and those in areas that need high-colour accuracy, this is worth checking out.

■ Keith Martin

Verdict

Features
Performance
Value



A no-nonsense screen that aims to impress with its colour quality, but suffers due to its flimsy frame.



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LAPTOP BACKPACK

\$399 | WWW.EVERKI.COM

Everki Atlas Wheeled Laptop Backpack

A big bag for carting behemoths.

Chances are high that if you're rocking a 17-inch laptop, you're playing games on it, and those beasts are big. This Everski laptop backpack can accommodate machines up to 17.2-inches, but it holds a whole lot more as well.

The laptop pocket is plush and thick, with adjustable straps to allow carriage of notebooks of various thicknesses and sizes. In the main pocket there's plenty of room on both sides of this envelope, to the extent that, if you're packing relatively lightly, this bag could be all you need for short business or pleasure trips. There are six smaller pockets on the front and sides – including an RFID-shielded one that can stop people from surreptitiously cloning things like your passport – and there are further, smaller pockets inside many of these, while the wheels and a retractable handle make it perfect for airports. There are backpack straps

squirrelled inside a zip-up pocket at the back too.

With a 17-inch laptop installed (we had a Venom gaming laptop at hand), as well as all manner of other odds and ends, the bag is quite heavy, but the carriage options make it a pleasure to move around with. It's difficult to make such unwieldy beasts portable, but Everski has done a decent job – and with style as well. The conspicuous lack of bling and the muted, business-like aesthetic appeal of the bag no doubt contribute to the hefty \$400 pricepoint. Still, if you're willing to spend that much on gear, this bag feels durable enough to hold you in good stead for many years to come. ■ Shaun Prescott

Verdict

A stylish, versatile bag for gamers and business people with heavy loads.



PORTABLE SSD

FROM \$199 | WWW.SAMSUNG.COM/AU

Samsung Portable SSD T3

Super-fast storage for your PC, Mac or Android device, now even tougher.

With the SSD T3, Samsung's done something you don't normally see in consumer electronics – it's made a product physically bigger than its forebear.

It's bigger, and it's better: the plastic chassis of the T1 has now been replaced with a tough metal housing, which means it can take a 2m drop and also feels physically far more robust.

This is still a device for those who need uber-fast portable storage (the 1TB model we tested reached read and write speeds of 425MB/s and 396MB/s respectively), however, and it comes with a price tag to match. It's available in four capacities: 250GB, 500GB, 1TB and 2TB, ranging from \$199 to \$1,249. That 250GB model is actually fairly competitively priced – a 256GB USB thumb drive with comparable performance (like Corsair's Flash Voyager GTX) will set you back around \$300. Yes, the latter's a little more convenient due

to its more-compact size and all-in-one design (the T3 requires you to carry a small USB cable to plug it in), but is that really worth a 50% price hike? You still get hardware-based 256-bit AES encryption to secure your data against theft, should you misplace it, and if you encrypt the disk you'll need to use the included Windows, Mac and Android apps.

It's a fairly seamless affair as well, although you'll need to provide a USB dongle to be able to plug it into your Android phone or tablet. (Samsung's Galaxy S7 handsets actually include a suitable plug-adaptor in the box.) If you want fast, tough portable storage (and are willing to pay the price), this one's highly recommended.

■ Dan Gardiner

Verdict

A little cheaper and much more durable, this is an agreeable upgrade from last year's model.





GAMING CHAIR

\$629 | SECRETLAB.SG/AU

Secretlab Omega Stealth

A finely-tuned throne geared toward both casual and hardcore sitters.

When piecing together a gaming rig, the last thing you're probably thinking about is your backside. It's too easy — and makes sense — to prioritise spending more on high-end components than a seat, especially when it's this expensive. But for those seeking some 'gamer' style for the home office (or just have money to burn) read on.

After so many years of navigating flimsy flatpack instructions, assembling the Omega is a dream. The bundled instructions — plus supporting YouTube how-to video — are ample for what is literally snapping five wheels to an aluminium frame and tightening a handful of bolts. The racing-themed Omega is crafted from dense, cold-cured foam and clad in a supple and resilient PU leather outing (leather backing with a polyurethane surface) and, coupled with the neck rest and lumbar pillow bundled in the box, you shouldn't have a problem being comfortable in the long-term.

On top of the traditional chair-height, backrest tilt and lean positioning found on most office chairs, the Omega boasts great 'gaming-centric' armrests. With four-direction positioning (you can change the height, adjust their position front-to-back and left-to-right, as well as angling the armrests in-and-out) there's really nothing out there that can compare. It makes switching from an upright keyboard and mouse position (and the chair can actually fit under the desk) to a comfortable recline for controller use very quick and easy.

However, the Omega does come with a recommended height and weight range — between 160-180cm and under 120kg. That said, this 186cm reviewer found it very cosy. ■ **Troy Coleman**

Verdict

An easy-to-assemble, beautifully appointed seat geared toward gaming (and other stuff, too).



GAMING MOUSE

\$90 | WWW.CORSAIR.COM

Corsair M65 Pro RGB FPS Gaming

The king of the squeakers?

The M65 lineup has always been eye-catching. The aluminum chassis presiding over the whole sleek affair glistens on the undercarriage of this well-crafted pixel-pusher.

The 20g of adjustable weight locked in place underneath helps you configure the mouse to exactly the right heft. The finish, unlike that of its elderly cousins, is now split — the thumb and pinky side rests have a hint of sandblasted elegance, while the top features a soft-touch rubber-coated finish.

It's definitely on the larger side of things, but still lends itself to a comfortable palm grip. It's not long but wide in its overall footprint. That's not to say those fingertip and claw grip users among you will be out of luck, as it's chunky enough and wide-spread enough to make that style achievable, too.

The M65 Pro loses out to the likes of the more button-heavy competition. In reality, short of the obvious buttons, you only

get those old-school forward and back buttons, followed by a shift hold reduced-DPI button, flatteringly adorned with a crosshair logo. The M65 Pro would be damn near perfect if this one button was removed. Add another slimline button to the opposite side, and it would be flawless.

What is nice about this little beauty is that we're finally stepping away from laser sensors in favor of more precise, high-range optical sensors to achieve a staggering 12,000 dpi. Zero jitter, zero interpolation at higher DPI settings—surface accuracy with optical sensors is phenomenal, and it's something that we're really glad to see becoming the norm when it comes to good mouse design.

■ **Zak Storey**

Verdict

Nae-perfect, thanks to soft-touch finish and adjustable weight. However, it needs one more button.





GAMING KEYBOARD
\$210 | WWW.CORSAIR.COM

Corsair K70 RGB RapidFire

Exclusive switches increase speed but reduce clicks.

There are so many mechanical keyboards on the market at the moment that it can be hard to distinguish one from another. The K70 RapidFire has something you won't find anywhere else, however: its switches.

Those switches are the new Cherry MX Speed models, exclusive to Corsair for now, which answer the call from about 1 percent of the PC gaming universe for keyboards that respond more quickly. On top of the switches sit the keys, and they have a gratifyingly large character window on top of them, the better to let through the coloured lighting that you can make flash and coruscate with the bundled software.

The space bar has a textured surface, reminiscent of Corsair's Strafe keyboards, so your thumbs don't slip off it. Elsewhere, you'll find the always-welcome Windows Key Lock switch, some media playback controls, and a metal volume roller.

There's also a useful USB port on the back, though unfortunately it's not USB 3.0. A BIOS switch adjusts the polling rate if the K70's super speed means it refuses to work with your motherboard, and the keyboard has the usual rollover and anti-ghosting tech to ensure your inputs don't get garbled.

Underneath all that, the frame is aircraft-grade aluminium, apparently designed to survive a lifetime — it doesn't say whose — of keystrokes. Keyboard switches are very much a matter of personal preference, but the feel of these linear switches won't be for everyone, and the extra speed gains cleverly engineered by Cherry will benefit even fewer.

■ Ian Evenden

Verdict

Sturdy build and quick keystrokes; USB pass-through. Unsatisfying feel, thanks to the linear switches.



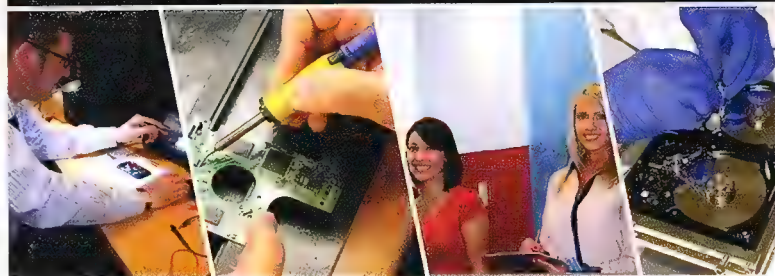
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WIRELESS GAMING MOUSE

\$199 | WWW.GAMING.LOGITECH.COM

Logitech G900 Chaos Spectrum

Nailing that wireless conundrum.

Logitech's G900 Chaos Spectrum seeks to innovate in one of the most difficult markets to master — that of the wireless gaming mouse. Long despised by 'true gamers', wireless mice have earned themselves a reputation fraught with woe. Whether that's jitter bugs, interference issues, sluggish battery life and charging methods, or a clunky design, there's always been something to put off gamers on the hunt for a truly cable-free experience. Can Logitech shake off the brutal dogma attached to wireless mice?

The G900 gleams when it's sitting in the box, and under the bottom packaging you'll find the optional secure lock Micro USB cable — for those battery-less moments you're caught short — and the wireless dongle housing. This also serves as a USB pass-through if you do intend to use the cable more long-term, and need a little extra length. The wireless 2.4GHz-capable dongle is minuscule in comparison to

the rest of the setup. Plugged into a keyboard's USB pass-through, it's hardly noticeable, making it a bit of a nuisance to remove.

The G900 sits comfortably in the grasp of a palm-gripper, reassuringly supporting your, well, palm, and protecting your pinkies from drag and discomfort. It almost feels like it's angling your hand upward, certainly compared to something like a SteelSeries Sensei or a Rival, as the angle falling off the back of the Chaos is far deeper than that of its competitors. This isn't a negative; instead, it makes it incredibly easy for those used to palming to swap to a more claw-like grip if need be — perhaps you've got a painful case of hand cramp today.

What's intriguing about this unit stems from Logitech's Gaming Software, which is how the Spectrum manages that mighty 500mAh battery sitting in its guts. In short, there's an ace battery tab on the bottom row of the software. What's interesting here — and a

rather obvious inclusion that makes us wonder why doesn't everyone do this — is that it shows you how much battery life you have left, calculated in both percentage and hours. The thing is, it also contains four different settings for lighting presets: Colour Cycle, Cyan Breathing, Lights Off, and My Setting, all of which affect how much predicted battery life you have left. For instance, at 45 percent, Colour Cycle nets us 11 hours of estimated usage. However, if we were to go to Lights Off, we gain an additional three hours of battery life. Yep, those two tiny LEDs, which you rarely see when your palm hits the metal, eat up almost a third of the overall battery life. And if that's the case for the Chaos Spectrum, you can bet your backside it's the same for other wireless peripherals — looking at you, headsets.

All RGB lighting aside, the G900 Chaos Spectrum is a stunning peripheral. The unlockable middle mouse wheel for continuous

scrolling is a dream, the additional buttons useful, the comfort great, battery life good, and utility excellent. On top of that, it's impressively light — questionably so, considering it's still lugging around that 500mAh battery internally. Precision is great, and using it over a lengthy time — one working week — we haven't come up with any problems. There's absolutely zero jitter or wireless anomalies from this 2.4GHz beauty, certainly in our testing, and on top of that, the huge number of features gracing Logitech's Gaming Software is more than enough to keep even the most ardent esports lover happy.

■ Zak Storey

Verdict

Features
Performance
Value



Hugely versatile, incredibly comfortable, lightweight and reasonably priced (for a wireless mouse). There's a lot to like.





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Enjoy Immersive Virtual Reality Experience

Industry Only Auto-Extreme Technology
Premium Quality and Best Reliability

GPU Tweak II with XSplit Gamecaster
Intuitive Performance Tweaking and Instant Gameplay Streaming

software

» APPS FOR ALL THE PLATFORMS



Windows SOFTWARE

Capture One

This art tool is no longer just about the 'capture'.

US\$299 | PHASEONE.COM

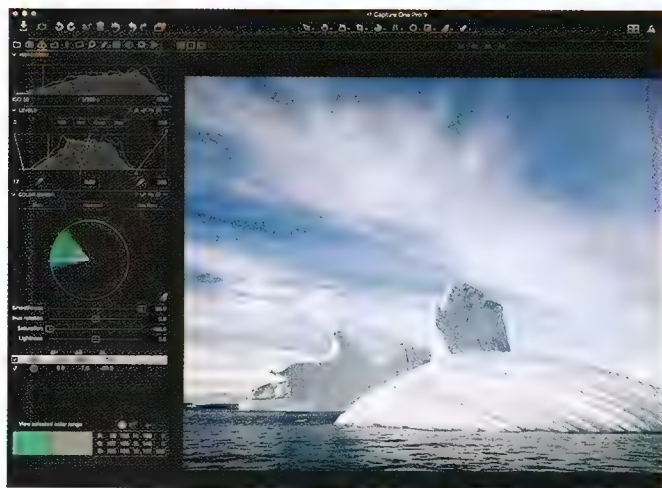
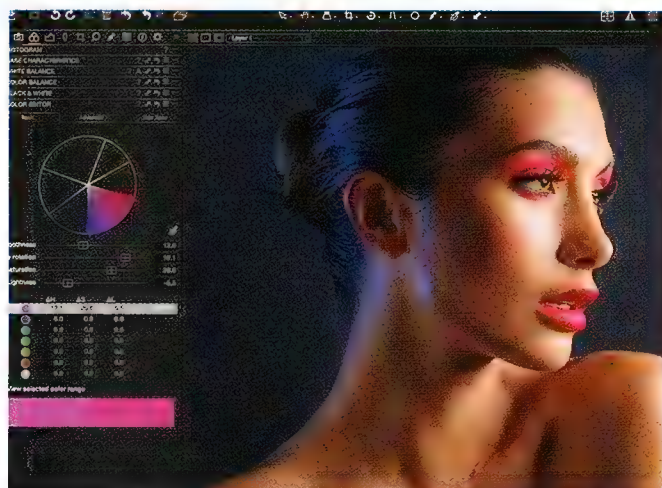
1

Capture One made its name as a professional solution for tethered shooting when using Phase One and Mamiya Leaf medium format cameras. Nine editions down the road, that's still a strong facet of the program, with seamless tethered shooting facilities that now extend to compatible Canon, Nikon and Sony cameras.

Not only do you get 'live view' for accurate composition, focusing and exposure adjustments, but pro photographers can also use it to liaise with remote clients during a shoot, with the aid of Capture Pilot for iOS. Online sharing is also supported. The program has powerful organisational tools to create a library of your shots. The suggested method is by creating a Catalog. It makes sorting trivial, with high-end database tools that enable you to apply star ratings, colour-coding, keywords, dates and locations. This comes complete with filters and search criteria, making finding images a rapid procedure. Yet more options are available with the creation of albums and smart albums.

Capture One really comes to life in the quality of its raw processing tools, empowered by a brand new processing engine. Any changes and edits that you apply to files are entirely non-destructive. Adjustments are divided into various tabbed panes, including colour, exposure, lens corrections, composition, details and local adjustments. Global and selective adjustments are available.

However, it falls a long way short of the advanced layer facilities in Photoshop. **Matthew Richards**



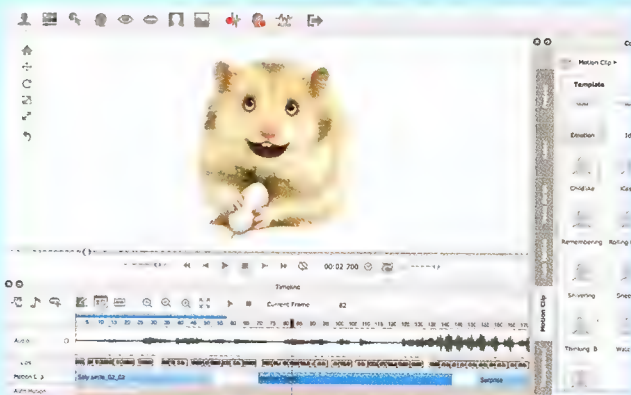
CrazyTalk 8 Standard

US\$49 | REALLUSION.COM/CRAZYTALK



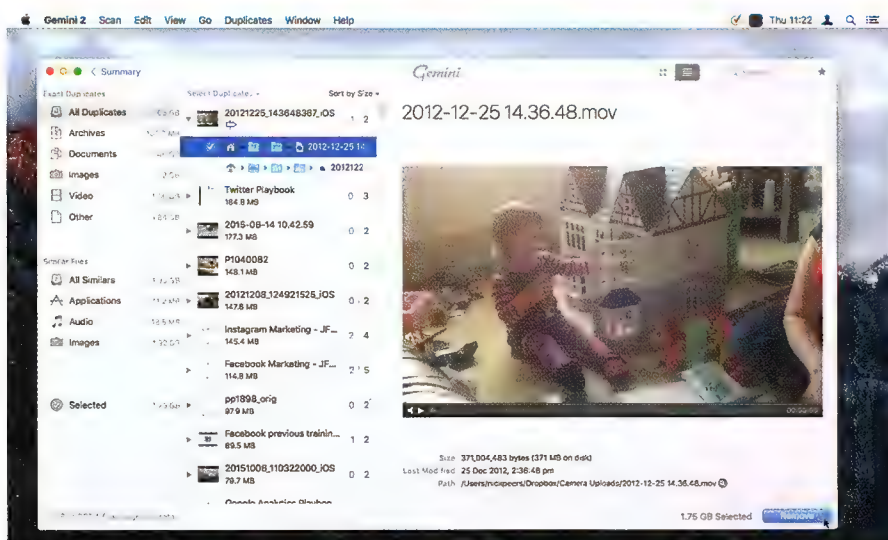
CrazyTalk is facial animation software. You import images of a face, or work with pre-defined templates, gradually adding to and refining a 3D talking head that dynamically responds to scripts. Once you're happy with your creation — be it an angry painting, jovial talking pumpkin or cartoonish superhero — you export the results as a movie to entertain and/or horrify your friends.

The software comes in three different versions. Pipeline (US\$199) and PRO (US\$149) are aimed at professionals. We're reviewing Standard (US\$49) here. It's a more limited, consumer-oriented tool, but very much not a toy. That said, work through the online documentation and you should get up to speed relatively quickly and the basics of the app are accessible by way of friendly walkthroughs. To get started, snap a photo of yourself, import it into the app, drag some lines and dots about so CrazyTalk knows where various bits of your face are located, and then stare aghast at the digital monster you've created.



Within 15 minutes or so, you too can have a kind of zombie mirror-image of yourself, lip-syncing to dialog. The effect somewhat resembles videogame characters from a few years back. CrazyTalk is entertaining and intriguing, but be mindful of the time investment it needs. **Craig Grannell**

Mac » APPS



MacPaw Gemini 2

Weed out your duplicate files.

\$30.99 | MACPAW.COM



Duplicate files are a pain to stay on top of, but thanks to Gemini they've suddenly become more manageable.

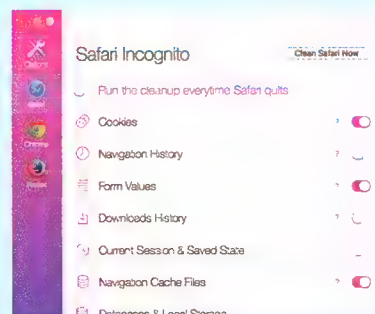
The original app targeted duplicates only, but version 2 can flag up similar files too, making them easy to compare and remove through its relatively straightforward interface. It also promises to learn from your decisions, such as which folders you favour when choosing files to keep, to ensure its one-click 'Smart Clean' is safer to use. Gemini can search iTunes and Photos libraries as well as folders – just choose where to search and let it strut its stuff. You can choose to trust the scan's findings and click Smart Clean, or exercise the more cautious (and sensible) option to review each entry. Duplicates and similar files are listed separately, and only the former are selected for deletion (you can choose 'Duplicate > Select > Deselect All' to clear what's preselected before review). The app provides built-in safeguards – files are moved to the Trash rather than deleted instantly, and a list of what's been removed is shown with options for restoring one or more items before finishing the job. Throw in innovative tools and options – the app can be configured to replace duplicates with hard links, for example – and you're left with a genuinely useful tool. Nick Peers

TextExpander 4



FROM US\$40 PER YEAR | TEXTEXPANDER.COM

When an update to an app is released, people usually focus on what's new. With TextExpander 4, the focus has been on what's missing. SmileOnMyMac now has its own cloud-based syncing platform for TextExpander, which replaces Dropbox and iCloud and enables group sharing of snippets. The subscription model introduced for version 4 costs about US\$40 a year, compared to the \$7.99 that TextExpander 3 cost outright. After an outcry, upgrade pricing of US\$20 is available for existing customers, and version 3 has returned for people who want to stick with other cloud services for syncing or don't want subscription software. TextExpander remains a wonderful app. It installs as a third-party keyboard in iOS and offers improved autocorrection and all kinds of snippets, from frequently used text, dates, emoji and phrases to formatted text and code blocks. Many big-name apps support it directly, and the TextExpander keyboard covers the apps it doesn't integrate with. But you can say the same about the old non-subscription version too, so best stick with that. Gary Marshall

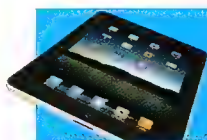


Incognito – Privacy Protector & Cleaner



\$14.99 | INCIGNITOFORMAC.WORDPRESS.COM

Incognito selectively wipes out hidden browser data anytime, leaving no trace of your activity behind. The app lives in the menu bar, from where you can open the main window for granular control over each browser, or choose which ones are set up for automatic cleaning. The software works best with Safari, offering 13 options ranging from routine cleaning of cache files and notifications, all the way to up purging bookmarks, clearing stored passwords, or wiping out installed extensions with a single click. Chrome and Firefox are supported, but there are fewer options. Incognito can be configured to purge data whenever you quit one or more browsers, or you can manually select an application from the left, and click Clear Now button in the upper right corner. Incognito also works well as a troubleshooting tool, since it can reset preferences and restore browsers to the way they were when first installed. It's not cheap and there's no option to hide the app icon from the Dock, but otherwise Incognito gets the job done. J.R. Bookwalter



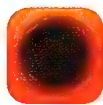
App Store » iOS APPS



Hear — Advanced Listening

It sounds relaxing.

FREE | WWW.HEARAPP.IO



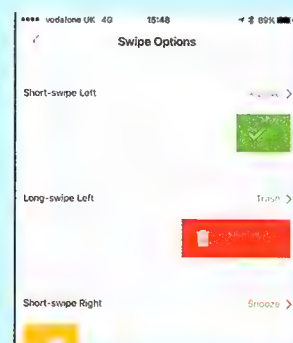
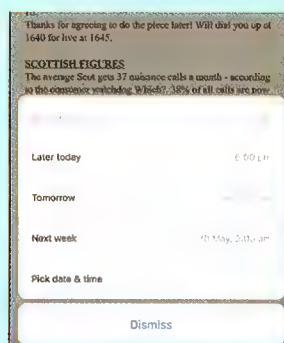
Active noise-cancelling headphones are great for helping you nod off by blocking out disruptive noises, or just ensuring you don't get distracted by loud things in the office, but good sets are also quite pricey. Hear — Advanced Listening is a new iOS app that uses your iPhone's (or a connected headset's) microphone to record what it hears and play it back to you in real time. At first, this may seem a little silly, considering you can probably already hear what is going on around you, but this real-time processing can actually allow you to boost the audio signal and make it seem like you have superhuman hearing. This is great as a novelty, but the Hear app really comes into its own when you start to tweak this sound to actually diffuse the harsh noises that are distracting you or keeping you awake. There's Office, Sleep, Relax and Talk modes that utilise specific reverb, echo, pitch modification and harmonics to turn distracting noises into something that sounds like the soothing song of a wind chime. This is an excellent, and free, first step towards achieving a zen-like auditory calm. Joel Burgess

Email — EasilyDo Mail

FREE | EASILYDOMAIL.COM



EasilyDo Mail is pretty close to being the perfect iOS mail app. Let's get the imperfect bits out of the way first. Exchange and iPad support isn't coming for a while yet, and you'll need to wait for the next build to use Gmail aliases. And sometimes the formatting is a bit off. Now for the good stuff. It's extremely fast — much faster on Gmail than Apple's Mail app — and it has smart Assistants that automatically find and organise purchases, tickets and travel documents. It has a unified inbox, email snoozing, Undo Send and Undo Delete, and similar one-click unsubscribing to the Unroll.me online service. If that sounds rather like Google's Inbox, that's because it is — but it's done so much better by EasilyDo. It's as good-looking as anything on iOS, it's packed with useful customisation options — including 3D Touch actions — and its Assistants are intelligent and useful. It can block email tracking and read receipts, its search makes Mail.app's search look embarrassingly slow and it's very fast even on overstuffed Gmail accounts. For us, all that's missing is Gmail aliases — we're one build away from embracing EasilyDo Mail as our everyday email client. Gary Marshall



Logo Foundry

FREE WITH IAP | WWW.LOGOMAKERAPP.COM



If you don't have access to a graphic designer to create a logo for your business, or perhaps want to try to mock up a few ideas before going to see one, then Logo Foundry could be a great little tool for you. Start off by adding either an icon or text — each will be placed on their own layer. The amount of images the app provides is pretty vast, separated into categories such as cleaning, pets, catering, construction, beauty, advertising, etc. Many of the items inside these categories are locked, however, which is where the in-app purchasing comes in. I attempted to create a logo for a cat café (but, of course, I did...). While hardly worthy of much (or any) praise, the results I achieved show what someone with very little knowledge of graphic design can achieve with this app in under ten minutes. There is a section where you can manage layers (selecting them on the page was a little difficult), and options for each layer on opacity, size, orientation, colour and, for text, font. Once you're done, save, scrap or share! Carmel Sealey



Google Play » ANDROID

Sleepfulness

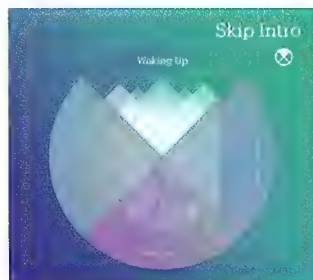
Better zeds in bed.

FREE WITH IAP | WWW.SLEEPFULNESSAPP.COM



Sleepfulness employs familiar meditation techniques, presented in a series of four dedicated chapters to not only help you get to sleep easier, but to think positively and energetically once you're awake.

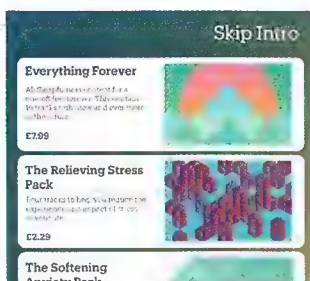
Essentially, it's a series of podcasts, each narrated by a soothing but authoritative voice that, in one recording, will have you focusing on your body as you lie in bed, then as you rise being very aware of what you want to achieve in your day. You'll gain more from the audio programs if you treat Sleepfulness as a holistic program, though you're free to pick and choose what you want to do. You could play this with headphones in, or on your phone's loudspeaker or bluetooth speaker. The latter two options are probably best if you're falling asleep, as you can drift off without having to untangle yourself from headphone cords. Additional episodes in each chapter cost ~\$4.70, but you can get the lot for ~\$16 on Android, or \$4.49 and \$14.49 on iOS, which is pretty good value. **Paul Taylor**



Sleepfulness has mindfulness tracks for four different Timezones: Going to Sleep, Can't Sleep, Waking Up & Daytime.

The Timezone is automatically chosen but you can explore them by tapping the icon in the image shown here.

Entering your typical bedtime in Settings will adjust the Timezone timings



You can buy additional packs of Sleepfulness tracks in the Store.

Each pack contains four tracks, one for each of the four Timezones and are designed for helping with common sleep challenges such as Stress & building more positive qualities.

You can also buy all current & future packs for a single low price.



Slidebox

FREE | SLIDEBOX.CO



Here's yet another app that will organise your photos for you, and it's not a bad one. Slidebox lets you organise photos into albums in a fairly intuitive way: just flick through your recently taken photographic masterpieces and drag them into the relevant folder that you've created. For people too order-obsessed to allow their whole collection to sit in one huge root folder, it's a godsend (though so are the other hundred-odd apps that do almost the same thing). In the version of Slidebox we used, these folders are created on your phone's main drive, so you'll see them even if you use the vanilla Android photo browser later. Among the most interesting features is the ability to email or share whole albums at once, which is particularly useful if you want your mum to see all 534 photos of you lounging, Crown Lager in hand, in your pink blow-up pool. Other than that, it's a pared-back app that does exactly what it says on the tin — and there are no in-app purchases to speak of either. **Shaun Prescott**



TapTapSee

FREE | WWW.TAPTAPSEEAPP.COM



TapTapSee performs a very impressive trick: turning images into sounds. Many modern Android-powered smartphones have a 'talkback' function that reads out the screen. Rather than immediately activating an app or icon, the first press reads out the element — like the Home button, the name of an app and so on — while double tapping actually activates it. Useful if everything has text attached to it, but what if you're trying to get a description of an image? That's where TapTapSee steps in. Take a photo of any object, and as long as you're connected to the Internet, it will describe it as best it can — and the results can be incredible. They can also be way off. One of this writer's holiday snaps came back with a very good description of 'man in brown crew neck shirt sitting beside man holding flute glass', while a yellow highlighter was described as, er, blue. It's far from perfect, but as a visual aid, it's a firm first step. **Paul Taylor**

Windows Store » WIN PHONE 8

CamScanner

Get more out of your smartphone's camera.

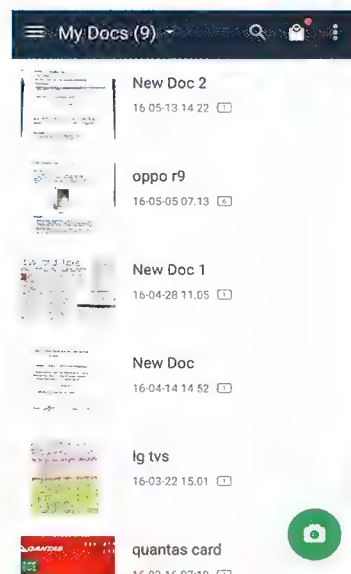
FREE | WWW.CAMSCANNER.COM



CamScanner is one of the better smartphone document scanners on the Android and iOS platforms. It's also made its way to Windows mobiles.

That said, it still hasn't been converted to a Universal Windows 10 app, so you'll only be able to access it if you have a device running Windows Phone 8.1. For those who can download it, CamScanner will save you from ever needing to open the lid on your flatbed scanner ever again. Using your smartphone camera to 'scan' (photograph) documents and save them as either a PDF or JPEG, the app allows you to share these files with either OneNote or save them to OneDrive. After the photo has been taken, there are a range of lighting, colour and rendering tweaks you can make to make the document more legible.

Further to this, the app includes a decent range of note-taking, tagging and highlighting manipulations that you can do over the top of the digital document. A recent upgrade to the WP8 offering adds the ability to scan QR codes to the app's already impressive document and business card optical character recognition capabilities. The Windows Phone edition has the exclusive ability to send OCR-recognised text directly to Word, so we'd definitely snap this one up. **Joel Burgess**



Video Editor Master

FREE; PRO VERSION, \$1.19 | WWW.QUEENLOFTAPPS.COM



Considering that last year, a film on the shortlist for the Sundance Film Festival was shot completely on a (now outdated) iPhone 5, it's clear that the latest smartphones are capable of producing video footage of an exceptional quality. And although there are obvious hurdles that mean running full video-editing software on a smartphone isn't particularly realistic, apps like Video Editing Master do provide an excellent solution to some of the simpler issues that arise from smartphone video. Offering a range of editing options including clip trimming, photo integration, slide-show creation, text overlay and music alignment, the app will give you the tools to do most simple video editing tasks. If that's all you need and you don't mind a minimal amount of

advertising then the basic free version of Video Editor Master is perfectly adequate. However, the \$1.19 upgrade not only removes all the advertising, but also adds a suite of visual effects, filters and contrast settings. **Joel Burgess**



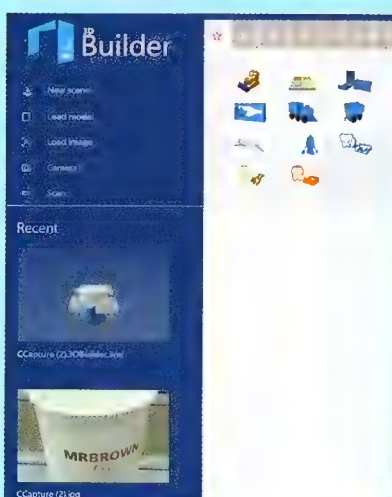
3D Builder

FREE | MICROSOFT.COM/3D



This Microsoft app was first released for the Windows 8.1 platform all the way back in 2013, and since then a number of significant improvements have been made on the interface, producing the refined app that's available today. 3D Builder is a 3D modelling tool that is light enough to run on your smartphone but has intuitive controls to make it genuinely useful. Though the numerous iterations of this app have made it a staple for anyone wishing to create 3D models on their Windows Phone or tablet, in May the Italian Windows blog announced that the 3D platform would now enable the integration of photos into 3D models. This new feature allows you to take an image of a particular object that will be automatically run through software to isolate the element

you are looking for and added to a 3D model construction. Though 3D builder is still a little lightweight to build professional 3D models for printing, it is a powerful application to have in your pocket if you want to model basic objects on the fly. **Joel Burgess**



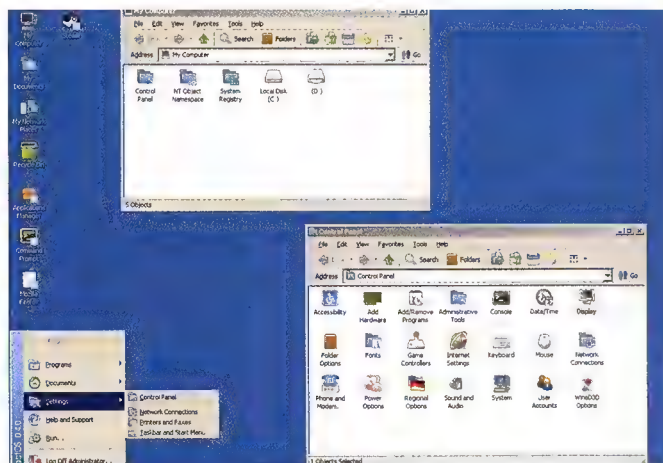


Linux SOFTWARE

ReactOS 0.4.0

A version of Linux that strives to provide a drop-in replacement for Windows.

FREE | WWW.REACTOS.ORG



ReactOS aims to be an open source OS that's binary-compatible with Windows applications and drivers. Ultimately this boils down to chasing not only a moving target, but (thanks to the closed nature of all things Windows) also an invisible one. Not only that, but the team has had to be very accurate about its reverse engineering strategy in order to remain on the right side of copyright law. So we can forgive any perceived delay in shipping a final (or beta) version.

At present, ReactOS aims to provide a kernel that's compatible with Windows NT 5.2 (Server 2003) and a userland that's compatible with NT 6.3 (Windows 8.1). What it categorically isn't is Wine running on top of Linux — you can't push Ctrl-Alt-Whatever and hide from the Start button in a virtual terminal, nor can you even run Linux binaries. To confuse the issue, Wine and ReactOS do share some code, specifically Wine's implementation of various Win32 services and libraries.

You can download either a live CD or an installer for ReactOS. The live CD did not work well outside of VirtualBox, but we were able to use the install medium. The boot process prints Windows-style device paths and then, sure enough, first impressions look and feel just like Windows 2000 or XP in classic mode. But after some clicking around you realise things are a little barren. Granted, all the core Windows apps (Sound Recorder, Wordpad etc) are there, but these aren't very interesting. The most conspicuous absentee is a web browser. Be aware that this is quite a small selection, but the Internet & Network category did include a couple of versions of Firefox and Opera, together with some less-well-known browsers. You'll also find Steam and an older version (4.4) of LibreOffice.

All the software in the Applications Manager has been tested with ReactOS. That isn't to say that it all works entirely as expected, but when it doesn't issues are usually

Gnome Photos

FREE | BIT.LY/GNOMEPHOTOS

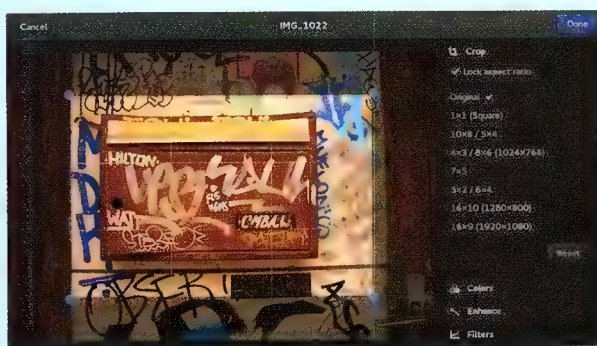
Selfie-obsessed Instagram fans and bearded Unix gurus are perhaps two entirely different crowds, but the typical Linux user will still want to stream their photos and watch what other people share.

Instagram doesn't ship an official client for Linux, but there are some alternatives, such as Photostream, an Elementary OS app, and XnRetro from the XnView developer. The first is quite unstable and is a simple — yet buggy — wrapper for the Instagram website, while the later isn't open source.

To the joy of all Gnome users, the latest release of the beautiful desktop environment, also known as Gnome Shell, includes a feature that fills this gap and offers Instagram-style filters directly to your Linux desktop.

Starting from version 3.20, Gnome Photos can now perform basic image editing. You can crop, change colour settings, apply auto-enhancing and add a more personal touch to your images using a number of built-in photo filters. The Filters section contains trendy retro filters such as 1977, Brannan, Gotham, Hefe and Nashville, which all simulate the respective film-like effects. You can click each filter and see how it is applied to your image in real time. Gnome Photos does all this action in non-destructive mode, so that your original image stays in its place. Push 'Done' when you are happy with the results, then go to the image menu and select Export to give altered image a new name.

While Gnome Photos isn't a full-fledged image editor, it is perfectly capable for simple edits and applying retro filters. Alexander Tolstoy



minor and can be worked around by studying the bug tracker. Armed with a (mostly) working web browser, we were free to go and explore compatibility outside of ReactOS's curated offerings. The results were not inspiring. Older versions of the Nvidia driver can be shoehorned onto ReactOS, but we were still unable to play anything on Steam. It's odd that there's only read-only NTFS support in ReactOS. However, 0.4 brings out-of-the-box support for ext2, 3 and 4 and also has support for SATA devices as improvements to the Sound and USB subsystems. As such it represents a huge step forward, but alas, many more giant leaps are required before the project becomes useful for the masses.

It's hard to find a solid use case for ReactOS: People looking to run the latest versions of Office or Photoshop are going to be disappointed and people looking to run older (or just better behaved) Windows titles would be better served with Wine or even a VM. Jonni Bidwell

Smash online geoblocks

Nathan Taylor reveals how you can use VPNs and smart DNS services to dodge geoblocks and access all the world's content.

Even with Netflix, Presto and Stan, Australian content offerings still lag behind much of the rest of the world. Our Netflix library, for example, is anaemic compared to the US Netflix selection. We still don't have access to video streaming sites like Hulu, or Amazon Instant Video or a number of other great services available to overseas users – and we can't access the US services directly thanks to geoblocking.

Unless, of course, you use an anti-geoblocker. This month we're going to take a look at the two most common work arounds for geoblocks: VPNs and smart DNS services.

VPNS VS SMART DNS SERVICES

There are two major methods of dodging geoblockers: VPN services and smart DNS services.

VPN services route all your internet traffic through a third party server. Everything you do online will appear to come from the IP address of the service provider. That has a number of advantages. It's service-agnostic, which is to say that it will work for any streaming service. You can switch locations to get access to content in the

country of your choice, which is great for the multi-lingual. And it has benefits beyond media streaming; since the link between you and the service provider is encrypted, local snooping on WiFi hotspots is foiled and even your ISP and government doesn't know what you're doing online. It also obscures your IP address when you download from things like BitTorrent, so peer to peer downloading is 'safe'.

Smart DNS services work a little differently. The provider sets up proxies for specific streaming services, which will be listed on the provider's web page. For example, they may set up a proxy for Netflix US or Hulu. It then provides you with a special DNS server address that you can enter into your internet settings. For most activity, the DNS server does what a DNS server normally does: translates URLs (like apcmag.com) into IP addresses for internet routing. But when you go to a supported service (say netflix.com), instead of giving your device the 'real' address it will return the proxy address, so your device will access the proxy instead.

The advantage of this is that it's completely transparent to the end user. All online activity appears quite

Breaking it down

VPNs

Pros:

- Easy to set up on the major platforms (PCs and mobiles).
- Allow you to easily switch between locations (want Netflix Germany, for example?).
- Service-agnostic. All online media streaming services are supported.
- Obscures all your internet activity from business, ISP and government snooping. This includes downloading from peer to peer services like BitTorrent.
- Provide security on public Wi-Fi hotspots.

Cons:

- Difficult to set up on other platforms, like game consoles and network media players. Generally requires some fairly hardcore router modifications.
- More likely to be foiled by anti-geoblocker detections systems.
- Affects the performance of all sites and services, since all will be routed through the VPN. (Which is to say, you'll likely have to constantly switch it on and off for 'regular browsing' and 'streaming'.)

Smart DNS

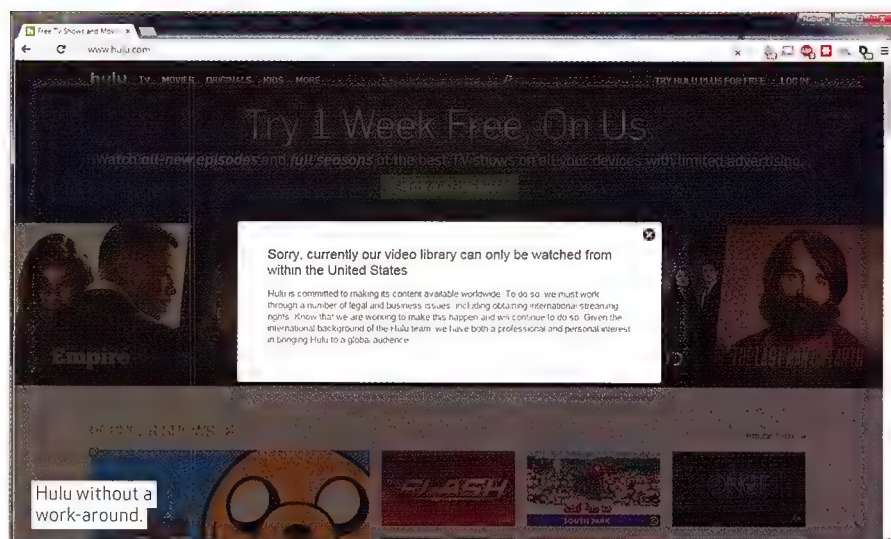
Pros:

- Easy to set up on all platforms, including consoles and appliances. All it requires is a change in the DNS settings.
- Doesn't affect your other browsing activity at all.
- Providers have motivation to aggressively work around geoblocks and anti-geoblock detection systems.
- Lower cost than VPN.

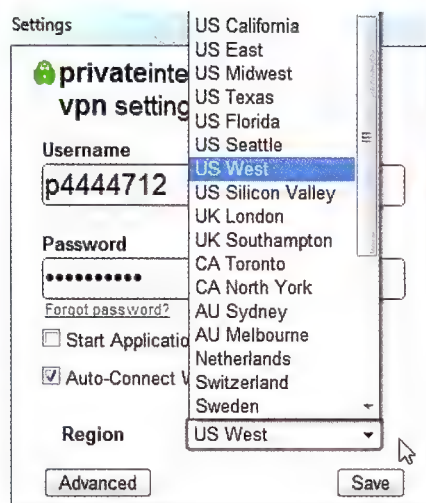
Cons:

- Only works with specific supported services and locations.
- Provides no additional security and privacy.
- Refreshing the IP address can be annoying.

"VPN services route all your internet traffic through a third party server."



Hulu without a work-around.



Pick where you'd like to be from.

normal, and you don't have to connect to anything or do anything, but when you go to **netflix.com** or **hulu.com** you'll be accessing the US sites as a US user. This simple transparency makes them appealing for a lot of users, since it 'just works'. They also happen to be cheaper than most VPN services. On the flipside, however, they provide no additional security or IP obscurity like a VPN does, and they only work with the specific streaming services that the provider has proxies for.

WHAT MAKES A GOOD VPN SERVICE?

If you're looking for a VPN service, there's a little homework you should do before handing out your credit card details. Things you should look at include:

- **Usage limits.** Look to the fine print: are there limits on the speed, the volume or the number of concurrent users?
- **Logging and privacy.** Check the provider's privacy policy. You want one that doesn't keep logs.
- **Setup options and instructions.** What platforms are apps available for? Does it have clear instructions on how to set up other devices, including routers?
- **Speeds.** This is a big one, since if the VPN can't sustain a video stream it's useless. Unfortunately, it's not something that the VPN provider will tell you – they will all say that they're "super-fast". For this you generally have to look to reliable independent reviews.
- **Cancellation policies and trial periods.** Related to the above point, if you're finding that the speed isn't up to snuff, or that the service doesn't do the things you want (like work around geoblockers), you want a way to get your money back.

SETTING UP A VPN ON A MOBILE OR PC

IP Address	Country	Region	City
104.238.169.124	United Kingdom	England	London

ISP	Organization	Latitude	Longitude
London Trust Media Inc	Not Available	51.508529663086	-0.12574000656605

"The first thing you'll need is a router that has VPN support. A handful of consumers routers do."

For the most part, setting up a VPN on a PC or mobile is as simple as installing an app provided by the VPN service provider. You install the app, enter your username and password and you're on.

Within the application, you can then choose which server you'd like to connect to. This will determine where your apparent IP address will be located. For example, if you want to access a UK streaming service, you can select a London server. Then, to any site you try to access, you will appear to be from London.

You can even head to **www.iplocation.net** to confirm that your geolocation is detected as a Londoner.

SETTING UP A VPN ON A ROUTER

Unfortunately, setting up a VPN service on a device that isn't a PC, Mac, iOS or Android device is not so easy. There are no simple apps you can install for PlayStations or smart TVs, for example.

It is possible, however, to set up your VPN service on a router so that all your internet traffic from all the devices connected to the router goes through the VPN. We should note that this is

somewhat complicated and it means all your traffic is going to be going at VPN speeds. It also doesn't allow easy switching between servers; you have to change your router config every time you want to change country.

The first thing you'll need is a router that has VPN support. A handful of consumers routers do (like ASUS routers), but more likely you'll have to install a third-party firmware such as DD-WRT (**dd-wrt.com**). That's not always easy; for DD-WRT, for instance, you'll need to go to and search the router database for your specific model. Then follow the install instructions for that router very, very carefully to avoid bricking your router.

Alternatively, you can buy some routers pre-flashed from places like **flashrouters.com**. We've included a full guide to flashing DD-WRT in this issue (see page 57), but we've provided a brief overview of the process below.

Most third party firmware sets your router's IP to 192.168.1.1. You'll need to plug your PC into the router and head to that address in a web browser to access the administration console. The default username is (usually, but not always) **root**, password **admin**.

The anti-anti-geoblockers

The game of one-upmanship continues.

Under pressure from rights holders, a number of streaming providers have started blocking VPN and smart DNS users from accessing their services. Most notably, Netflix and Hulu have begun blocking entire IP address ranges from accessing their services. Many VPN service providers have been affected, finding that their IP addresses have been blocked and therefore their users cannot access the services. Even users based in the US will find themselves blocked if they use a VPN to try and watch Netflix.

As is regularly the case in such circumstances, the situation has turned into a case of cat and mouse. Netflix blocks a VPN provider or smart DNS provider, so the provider implements a work-around. And then Netflix blocks them again, and then they work around again.

It should be noted, however, that some VPN and smart DNS providers have been more aggressive than others. Many VPN providers have not even bothered to look for workarounds at all, and will simply not work with Netflix US or Hulu or any other site that blocks their IPs. The smart DNS providers have been more aggressive (since it's their entire business model), but it's still a moveable feast whether they work or not. If you want to know if a specific provider currently works with the service you want, then prepare for some Googling and forum-searching.

From there you can set up the internet connection and wireless.

After your router is flashed and connected to the internet, you should head to the VPN provider's help page for a guide on how to set it up on a router. Again, carefully follow the instructions.

In general, there are three VPN protocols supported by most providers: L2TP, PPTP and OpenVPN. The first two are the easiest to set up, and generally only require a server address, username and password (note that, for many VPN providers, the L2TP/PPTP password is not the same as the primary password, and you'll have to visit your account page to find it). If you have a broadband router running DD-WRT, you can simply set your WAN connection type to PPTP or L2TP on the basic connection page and



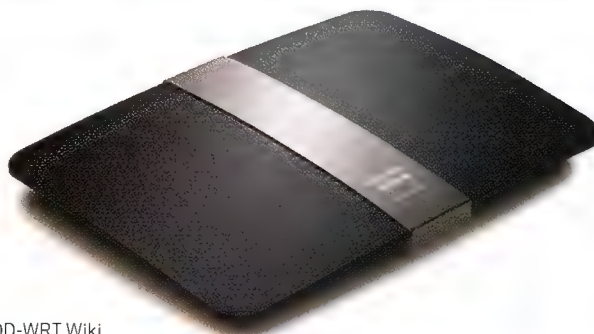
Linksys E4200

Contents [hide]

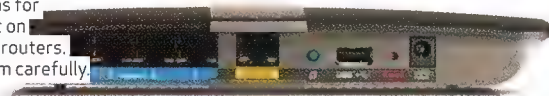
- 1 Hardware Specifications
- 2 Flashing
 - 2.1 Warnings
 - 2.2 Flashing Process
 - 2.3 Upgrading Process
 - 2.4 Reverting back to stock firmware
- 3 Wireless-N Configuration
- 4 References

Hardware Specifications

[\[edit\]](#)



The DD-WRT Wiki contains step-by-step instructions for installing it on supported routers. Follow them carefully.



"In general, there are three VPN protocols supported by most providers: L2TP, PPTP and OpenVPN."

enter the username and password and service provider's server IP address (found on its web page) into the fields.

Alternatively, you can head to Services > VPN and set up there.

It's on this page that you can also find the OpenVPN settings. OpenVPN is faster and more secure, but a lot more involved, and will likely require you to copy and paste scripts and cryptographic certificates from the VPN provider's web page. Again, you'll have to follow the provider's instructions carefully.

SETTING UP A SMART DNS SERVICE ON ANYTHING

Compared to VPNs, setting up a smart DNS is relatively straightforward. For any device that you want to use the smart DNS service, you'll need to go into its internet settings. Then you find

the DNS server setting and enter the DNS server number supplied by your smart DNS provider. Getflix, for example, has a Sydney DNS server of 54.252.183.4. Just change the DNS server to that.

Now there are two complicating factors. The first is that some devices don't let you set the DNS details unless you go for a full manual network configuration. This is annoying, but not insurmountable. If that's the case, then you have to know the local IP address of your router (that's the address that you enter into a web browser to access its admin console) enter the following details:

■ **IP address:** this will be the same as your router's local IP address, but with the last number changed to something between 0 and 255. For instance, if your router's address is 192.168.1.1,

dd-wrt.com control panel Firmware: DD-WRT v24-sp2 (02/19/14) mega Time: 15:20:19 up 49 min, load average: 0.00, 0.01, 0.04 WAN IP: 192.168.1.72

Setup Wireless Services Security Access Restrictions NAT / QoS Administration Status

Basic Setup DDNS MAC Address Clone Advanced Routing VLANs Networking CoIP Issues

WAN Setup

WAN Connection Type

Connection Type: **PPTP**

Gateway (PPTP Server):

Username:

Password: ☐ Unmask

Use DHCP: ☒ Yes ☐ No

MPPE Encryption: ☒ Enable ☐ Disable

Packet Reordering: ☐ Enable ☒ Disable

Receive IPTV: ☐ Yes ☒ No

Connection Strategy: ☐ Connect on Demand: Max Idle Time: 5 Min. ☒ Keep Alive: Redial Period: 30 Sec.

Additional PPTP Options: mppe required,stateless

Optional Settings

Router Name: DD-WRT

Hostname:

Domain Name:

MTU: Auto 1500

STP: ☐ Enable ☒ Disable

Network Setup

Router IP

Local IP Address	192	168	5	1
Subnet Mask	255	255	255	0
Gateway	0	0	0	0
Local DNS	0	0	0	0

Automatic Configuration - DHCP:

This setting is most commonly used by cable operators.

Hostname: Enter the hostname provided by your ISP.

Domain Name: Enter the domain name provided by your ISP.

Local IP Address: This is the LAN-side IP address of the router.

Subnet Mask: This is the subnet mask of the router.

DHCP Server: Allows the router to manage your IP addresses.

Start IP Address: The address you would like to start with.

Maximum DHCP Users: You may limit the number of addresses your router hands out. 0 means only predefined static leases will be handed out.

Time Settings: Choose the time you are in an summer time (DST) period. The router can use local time or UTC time.

For PPTP and L2TP services on a broadband router, you can simply change the WAN connection type.

PPTP Client

PPTP Client Options: ☒ Enable ☐ Disable

Server IP or DNS Name: pptp.vpnprovider.com

Remote Subnet: 192.168.1.1

Remote Subnet Mask: 192.168.1.1

MPPE Encryption: require-mppe

MTU: 1436 (Default: 1436)

MRU: 1436 (Default: 1436)

NAT: ☒ Enable ☐ Disable

Username: myvpnusername

Password: ☐ Unmask

You can find VPN settings in DD-WRT under Services->VPN, and from there you can configure the client.

- then you could set this to 192.168.1.50.
- **Subnet mask:** 255.255.255.0
 - **Gateway address:** Your router's IP address (commonly 192.168.1.1).
 - **DNS:** The DNS number provided by your smart DNS service.

Alternatively, you should be able to configure your router so that it hands out the smart DNS address to all devices on your network when they connect. It varies a little between routers, but generally you have to log

onto the administration console of your router and find the DHCP settings, which controls the auto-configuration of devices. Then you change the DNS number to that of the smart DNS service. Once you've that, devices that connect to your router will automatically be configured with the smart DNS.

The other complication is that DNS has no inherent authentication method, so the provider has no way of determining if you are a subscriber. So what the provider will do is require

Get the Hola outta here

The popular geo-dodging browser plug-in is a bit dodgier than expected.

Hola (hola.org) became famous as a genuinely free way to dodge geoblocks. Instead of a traditional VPN, it uses a peer-based method of getting around the blocks. Available as a browser add-on or installable app, Hola lets you route your traffic through other Hola users and it lets them route their traffic through your connection. So you could route your traffic through a US user to watch US Netflix, for example, and somebody could potentially use your connection to watch ABC iView from outside Australia (yes, it's a bandwidth risk, but that's the price of using it).

Unfortunately, the company behind it has proven more than a little shady. It was discovered that it was selling users' bandwidth for its commercial VPN product and some of the bandwidth was even being deployed in DDOS attacks. The app was also shown to have huge security holes, potentially opening up users to exploits. For these reasons, we'd recommend avoiding it. For an alternative, check out Hotspot Shield Free VPN Proxy (gethss.io).



that you register your current IP address with it by logging on to its web site. Once your IP is registered, it knows that any DNS requests coming from that IP address are from a subscriber.

Unfortunately, you'll have to do this every time your IP address changes (after a router reboot, for example). It's annoying, but there is a cure if you're willing to put in a little work up front. Follow these broad steps:

Internet Protocol Version 4 (TCP/IPv4) Properties

General Alternate Configuration

You can get IP settings assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for the appropriate IP settings.

☒ Obtain an IP address automatically

☐ Use the following IP address:

IP address: . . .

Subnet mask: . . .

Default gateway: . . .

☐ Obtain DNS server address automatically

☒ Use the following DNS server addresses:

Preferred DNS server: 8 . 8 . 8 . 8

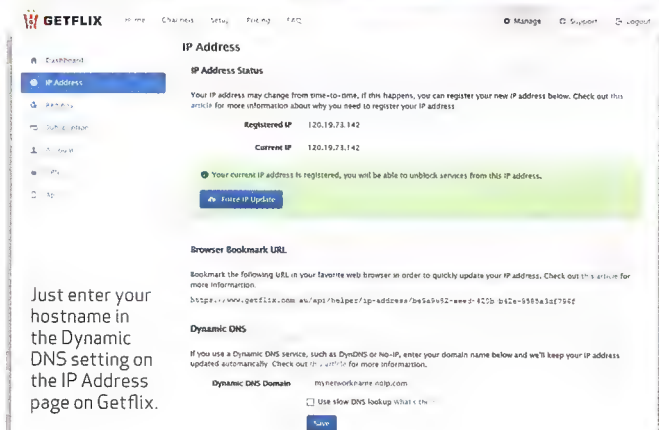
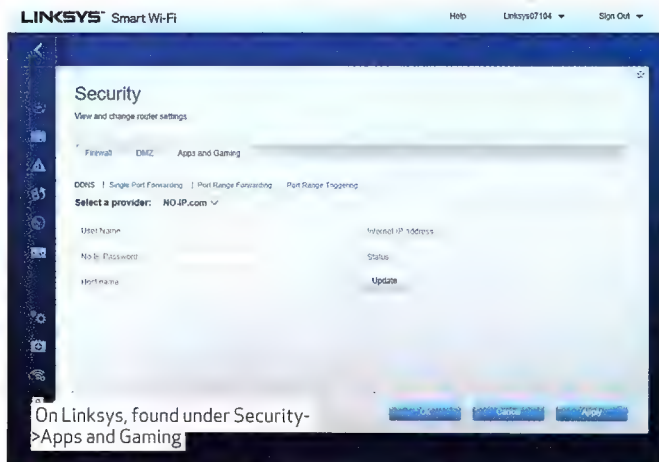
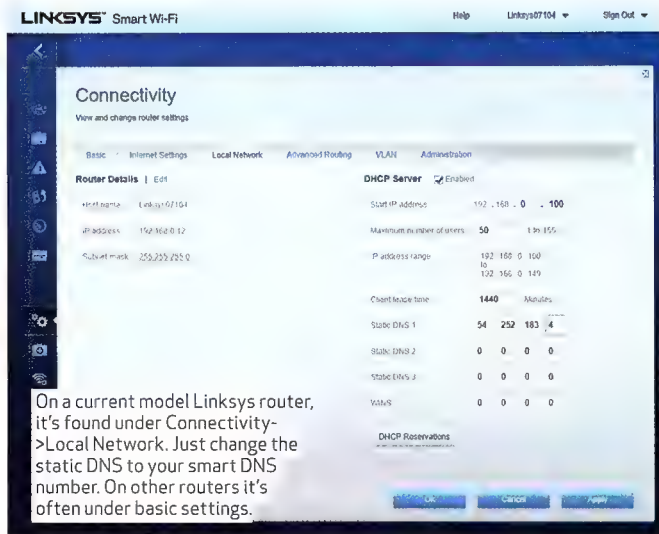
Alternate DNS server: 8 . 8 . 4 . 4

☐ Validate settings upon exit

Advanced...

Just change your DNS server address to the one provided by the smart DNS service.

OK Cancel



Subscribing to US services

How to jump through the hoops and get access to US-only subscription services.

Getting around the geoblock is possibly only part of the problem. If you want to access Hulu Plus, for instance, you'll still need a way to subscribe, and it may block international credit cards. (Netflix is a very notable exception: one Netflix account is good for the whole world – if you have an Australian Netflix account you can access US Netflix content just by logging in from a US IP address.)

The first thing you should do is just try to subscribe with your regular credit card. Hulu, for example, has historically rejected non-US credit cards, but there are reports of some working. (If you need a fake ZIP code when registering, go to **www.unitedstateszipcodes.org** and find a place where you want to pretend-live).

If that doesn't work, the best option is to get a gift card and/or time codes from stores like **www.buyfrompowerseller.com**, which obviates the need to provide credit card information.

Finally, there's the pre-paid credit card option. You can register for a virtual credit card at **entropay.com**. Then, create a US PayPal account, and link the Entropay card to it. Then pay for the service using the US PayPal account.

1 Go to www.noip.com and create a free DDNS hostname for yourself. It doesn't matter what the hostname is, just register one and make note of what it is and the username and password associated with it.

2 Log onto your router's admin console and find the DDNS settings. Enter the details of the No-IP account you just created, including the username, the password and the host name and save. Now that hostname will always point at your router's IP address.

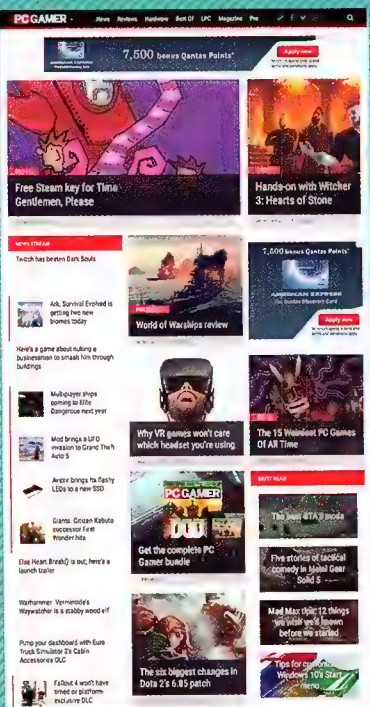
(Note that if your router does not have DDNS settings, there's a PC agent

that you can download from No-IP instead. Just install it and run it – as long as it's running, your DDNS IP will be up to date.)

3 Go to your smart DNS provider's web page and find the Dynamic DNS settings. Most allow you to register a DDNS URL in lieu of manually registering IP addresses. In the Dynamic DNS field, type in the full hostname you registered (such as ***mynetworkname.noip.com***).

Once you've done all that, your smart DNS is good to go – no need to do anything else.

SMARTER COOKIES ENABLED



JOIN US ONLINE AT
WWW.PCGAMER.COM

VPNs and smart DNS services compared

Looking for the best tools to slip past the site blocks?
Nathan Taylor rounds up the best subscription services to do just that.

This whole accessing Hulu, BBC and Netflix US thing sounds appealing, doesn't it? Unfortunately, some of those streaming providers have started making moves against the tools that have historically been used to bypass their geoblocks, banning entire IP address ranges from accessing their services.

So finding a VPN or smart DNS provider that can give you access to the streaming videos you want has become something of a lottery, especially since many of the providers that have been blocked actively work to obfuscate that fact.

So this month we decided to take a look at some of the most popular smart DNS and VPN services and see how they stack up when it comes to geoblocking. For VPNs, we'll also take a look at speeds and general security as well.

SMART DNS SERVICES

Smart DNS services offer the easiest way to unblock streaming sites on all your devices. A simple DNS server change is all that's needed to set them up on any device, which makes them very appealing for people who are only interested in bypassing geoblocks and don't care much about the security benefits of VPNs.

It should be noted that nearly all smart DNS services also offer VPNs, sometimes as part of the base cost and sometimes at additional cost. For this review, however, we wanted to focus on their smart DNS services

and what they can deliver. We'll get reviews of VPN services a little later.

VPN SERVICES

If you'd like a bit of extra security on top of your geoblock-foiling, and perhaps the option to download from BitTorrent anonymously, then a VPN is a better bet than a smart DNS service.

It does require more effort, however. Even those VPNs that have solutions to Netflix and Hulu's blockade tend to make you work for them, having to contact support, trawl forums and play server hopscotch to get it all functioning — only to have things change up and having to start again. Still, online anonymity and link security is not something to be sniffed at, and you may find it's worth the time.

HOW WE TESTED SPEED TESTS.

For VPN services, we ran tests using **speedtest.net** in both the US and UK. For the US, we connected to the primary US West or Los Angeles server within the VPN app. Then we performed the test against a server in Irvine, California. For the UK, we set the VPN location to London and tested it against a London server in **speedtest.net**.

The speed tests were designed to reveal just how much bandwidth the VPN services really provide, and an indication of whether they're suitable for media streaming. You can compare the result to our baseline (no VPN) speeds of

All the others

There are literally hundreds of VPN services available right now, and we don't have room here to cover them all.

However, if you're interested in seeing how the other services shape up, we highly recommend visiting **thatoneprivacysite.net**. That One Privacy Site took on the herculean task of cataloguing hundreds of VPN providers, detailing their security and anonymity techniques as well as their servers, stats and ethics policies. Look for VPNs that have a lot of green fields — it's good evidence of solid security and privacy practice.

29.93Mbps to the US and 16.62Mbps to the UK.

These results, it should be noted, are not universal for the VPN's servers. VPNs typically run hundreds of servers, each likely getting different results depending on the load on that particular server, and if you get a slow server you can often try different ones to get better speeds. However, the speeds are useful as a broad indication of the kind of contention rates the VPN provider is happy to sustain.

STREAMING TESTS.

For both Smart DNS and VPN services, we also tried connecting to and watching video streams from three major international (and normally geoblocked) services: Netflix US, Hulu and Amazon (US).

Amazon isn't aggressive about blocking VPNs and proxies, and worked in most instances. However, both Hulu and Netflix implement anti-proxy blacklists and are the true test of whether the provider can foil geoblocks.

In instances where Hulu or Netflix didn't work immediately from a US West/Los Angeles location, we tried to connect to two other points of

"Finding a VPN or smart DNS provider that can give you access to the streaming videos you want has become something of a lottery, especially since many of the providers that have been blocked actively work to obfuscate that fact."

TABLE HEADLINE

	SMART DNS SERVICES				VPN SERVICES					
	GETFLIX	UNLOCATOR	UNBLOCK-US	UNOTELLY UNODNS	CYBERG-HOST	EXPRESS-VPN	HIDEMYASS	NORDVPN	PRIVATE INTERNET ACCESS	TUNNEL-BEAR
MONTHLY SUBSCRIPTION	US\$3.95	US\$4.95	US\$4.99	US\$4.95	\$7.49 (1 DEVICE) OR \$12.99 (5 DEVICES)	US\$12.95	\$16.99	US\$8	US\$6.95	US\$7
YEARLY SUBSCRIPTION	US\$33.18	US\$49.95	US\$49.99	US\$47.95	\$74.99 (1 DEVICE) OR \$119.99 (5 DEVICES)	US\$99.95	\$111.48	US\$48	US\$39.95	US\$50
COUNTRIES	N/A	N/A	N/A	N/A	30	78	221	48	29	20
NUMBER OF SIMULTANEOUS DEVICES	UNLIMITED (SINGLE IP ADDRESS)	UNLIMITED (SINGLE IP ADDRESS)	UNLIMITED (SINGLE IP ADDRESS)	UNLIMITED (SINGLE IP ADDRESS)	1 OR 5	1 PC AND 1 MOBILE	2	6	5	5
KILL SWITCH	N/A	N/A	N/A	N/A	YES	YES	YES (PER APP)	YES	YES	NO
LOGS	NO	NO	NO	NO	NO	NO	SOME (SESSION & BANDWIDTH)	NO	NO	NO
SPEED TESTS										
SPEEDTEST.NET US WEST (BASELINE: 29.93MBPS)	N/A	N/A	N/A	N/A	10.2MBPS	29.87MBPS	1.61MBPS	26.75MBPS	0.63MBPS	8.73MBPS
SPEEDTEST.NET UK (BASELINE: 16.62MBPS)	N/A	N/A	N/A	N/A	3.42MBPS	5.49MBPS	0.55MBPS	7.44MBPS	0.57MBPS	1.04MBPS
STREAMING TESTS										
AMAZON PRIME/INSTANT VIDEO	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED
HULU	PASSED	PASSED	PASSED	PASSED	FAILED	PASSED (WITH SUPPORT)	FAILED	PASSED (WITH SUPPORT)	FAILED	FAILED
NETFLIX US	PASSED	FAILED	FAILED	FAILED	FAILED	PASSED (WITH SUPPORT)	FAILED	PASSED (WITH SUPPORT)	FAILED	PASSED

“If you’d like a bit of extra security on top of your geoblock-foiling and perhaps the option to download from BitTorrent anonymously, then a VPN is a better bet than a smart DNS service.”

presence if available. If we still couldn’t get it to work, we then searched the VPN provider forums (if available), then contacted the provider’s online support service (if available). If we still couldn’t find a Netflix or Hulu-capable server, the service failed.
(As an aside, we don’t think it’s reasonable to expect users to trawl Reddit and third-party forums for the magic server that still works; either the information is available from the provider itself, or it’s a failure).

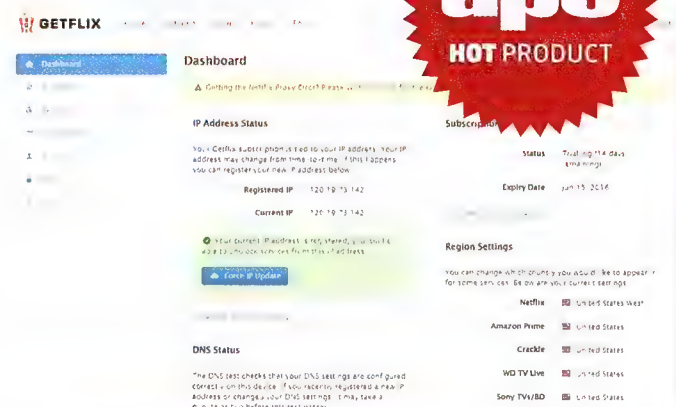
It’s very important to note that these test results were true as of June 1 this year. However, the cat and mouse game between the VPN/Smart DNS providers and content providers is still under way, and by the time you read this, things might well have changed.

The kill switch and logs

For the purposes of streaming, the kill switch and logging generally aren’t that big of a deal, but we’ve included them here for the purpose of being complete.

A kill switch is a feature of the VPN application that shuts off all internet activity if the VPN server fails. Without it, your internet connection will automatically (and probably without you knowing) switch back to regular non-VPN usage, leaving you potentially unprotected.
Logging is important for privacy. A provider that keeps no logs is ideal.

SMART DNS SERVICES



US\$3.95 MONTHLY; US\$33.18 ANNUAL | WWW.GETFLIX.COM.AU

Getflix

A universal bypass.

Our top pick for smart DNS services, Getflix has seemingly overcome Netflix and Hulu's anti-proxy tech, at least for now. At the time of writing it worked perfectly well with Netflix US. Startup is slow, and the playback resolution took a while to sharpen up, but it otherwise worked seamlessly. It was the only smart DNS service to accomplish that.

Getflix still hasn't managed to get universal Netflix going again, however. Only a handful of countries are supported right now, where once you could choose from 20 countries' Netflix libraries. According to Getflix, the others will be coming online eventually.

Beyond Netflix and Hulu, Getflix boasts an impressive array of support for streaming music and video services, including all the major subscription services, catch-up TV for the US and UK, as well as Pandora, Rhapsody and Beats music. There are also a handful of non-English channels

supported, in addition to the Australian and NZ catch-up services.

It also has an impressive set of DNS servers in 20 countries, and servers in Melbourne, Sydney and Perth ensure swift responses. Tested with the Sydney server, the response times were excellent; pinging the Sydney server has a response time of 92ms. For comparison, Google's DNS had 104ms from our test system.

For services that support multiple countries, you can choose your country from the Getflix administration page. You'll likely be visiting this page a lot, since you'll have to go there every time your IP address changes to re-register it.

All this added up to a very smooth experience with Getflix, working beautifully, and easy to set up and use.

Verdict

Gets it done, even with Netflix. A top pick.




US\$4.95 MONTHLY; US\$49.95 ANNUAL | WWW.UNLOCATOR.COM

Unlocator

Defeated by Netflix.

In spite of our best efforts, Unlocator failed to succeed at what many consider the prime directive of a smart DNS service: to unblock Netflix US. Even switching to Unlocator's Beta servers, specifically designed to defeat Netflix's anti-proxy tech, didn't get the job done. On the upside, it did work beautifully with every other service we tested it with, including Hulu and UK-based streaming services, delivering smooth video at full resolution.

It works with a decent number of other services as well, most of which are US-based. It doesn't support much outside the US, however, and only supports SBS among Australian services. For a handful of services that support multiple regions there is a region-selector, though it's not as clear or easy to use as that of Getflix, and region selection tends to be more global than per-service.

In fact, in general it's not as easy to use as Getflix. IP

address registration is more complex, and there doesn't appear to be a DDNS option, though there are third-party apps that will do the job as well as guides on how to set up Cronjobs on some routers and Unix-ish systems.

Ultimately, Getflix beats it on pretty much every metric. It supports fewer services that Getflix, costs more, is more challenging to configure, doesn't work (right now) with Netflix, and even its US-based DNS services are slower, with ping times of 292ms from our test system. It still works pretty well for most services, but there are clearly better options available.

Verdict

Inferior to Getflix in pretty much every way.



Unblock Your Freedom

Bypass blocks and protect your identity online

Be in different places at the same time. Appear in Canada for one web site and in UK for another.

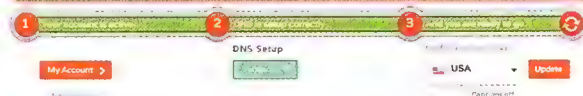
No software to install.

[Get Started](#)

For only \$4.99 a month



Looks like your internet address has changed. Please



US\$4.99 MONTHLY; US\$49.99 ANNUAL | WWW.UNBLOCK-US.COM

Unblock-Us

Falling behind.

One of the earliest Smart DNS services, Unblock-Us was also one of the first to receive the wrath of the Netflix ban hammer. From our testing, it still hasn't managed to overcome that ban, and Netflix is still inaccessible with the service, which is obviously a huge black mark against it. However, the other services we tested, including Hulu, all worked perfectly, with smooth playback at high resolution.

Unfortunately, the configuration and testing system is a mess. There's an appreciable number of features, including wide region selection for services and DynDNS automatic IP address registration, but they're buried deep behind a help system in which entire pages are missing and errors are frequent.

Still, there are positives: there are easy setup and management apps for people for whom DNS configuration is challenging. It automatically tells you which DNS server to use

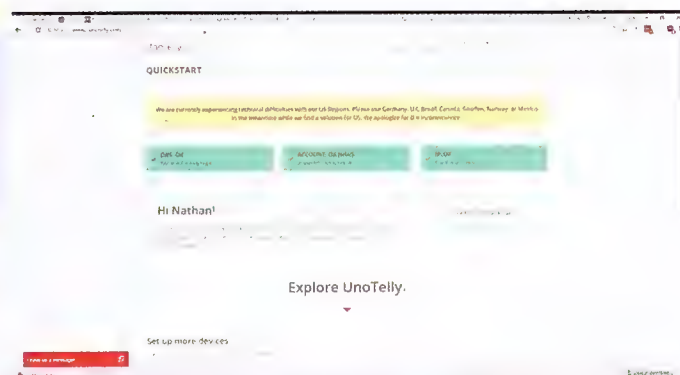
based on your location, and uses border gateway protocol to automatically route you to a local server. In our case, the ping result was a very good 118ms, indicating fast DNS response times.

The list of supported services is also very impressive. Most Australian, US and UK catch-up TV services are supported, as are most of the major subscription streaming services. Music channels like Pandora and iHeart Radio are there as well as a surprising selection of French TV channels.

Whether those are enough to make up for Netflix and the janky controls largely depends on what you're after. As with the other smart DNS services, Getflix still generally seems like a better deal.

Verdict

Once a top pick, but no more.



US\$4.95 MONTHLY; US\$47.95 ANNUAL | WWW.UNOTELLY.COM

UnoTelly UnoDNS

A sleeker design.

Like the other smart DNS providers here, UnoTelly has expanded its options to include VPN services, and indeed those services are now the primary thing it sells on its web site. Its original smart DNS service (called UnoDNS) is still available, however, and it's another service that has been hit with the Netflix proxy ban. As with Unblock-Us and Unlocator, this will be a deal breaker for a lot of users. However, it still supports other services just fine. We found it could be a little slow starting at times, but was usually capable of high-definition streams from international services.

And a lot of international services are supported. Over 300 different video and music streaming services are covered by UnoTelly, though it's not possible to individually select the country from which you'll use each one. Instead there is a single "global" location selector, which will determine your location for those services where there might be options.

It has DNS servers spread around the world, and visiting www2.unotelly.com/global-servers will very conveniently point you to the nearest one for your configuration. And the DNS servers were fast too — a Sydney server we used responded to pings in 68ms, which was significantly faster than even Google.

Other features include a DDNS IP registration tool as well as a solid help and FAQ system for setting it all up. There are some strange configuration elements — like selecting Approved Websites merely brings you to a page that says "We've been forced to change," whatever that means.

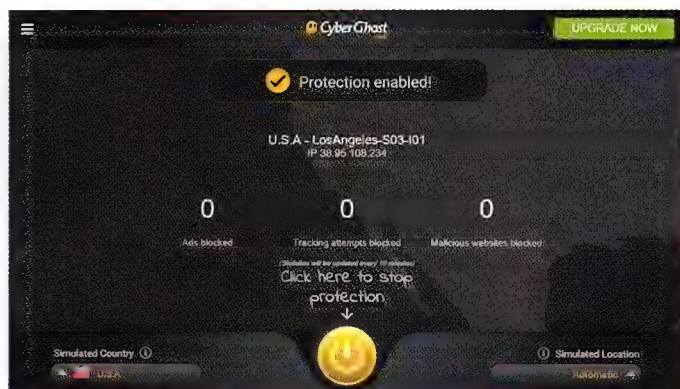
Of the four smart DNS services we've looked at here, we'd put it at a distant second behind Getflix, given that the latter has defeated the Netflix block.

Verdict

A smooth experience...mostly.



VPN SERVICES



\$7.49 (1 DEVICE) OR \$12.99 (5 DEVICES) MONTHLY; \$74.99 (1 DEVICE) OR \$119.99 (5 DEVICES) ANNUAL; FREE OPTION | WWW.CYBERGHOST.COM

CyberGhost

A fast service with a free or paid option

If you really don't want to pay for a VPN service, CyberGhost is one of a number of suppliers that now offers a completely free service. It's speed limited, times out after three hours and you generally have to wait in a queue to get connected, but it works. You don't even have to sign up or provide any personal information: just download and run the app or browser add-on.

And the speeds on the free service are actually quite reasonable: we hit 1.84Mbps to the US when we tested this service, which is plenty to support a smooth SD quality stream. If you want HD-quality streams, however, you'll have to subscribe. With a subscription active, we hit 10.2Mbps to the US, which is good enough for even high definition streams. The paid service also gets you access to the full list of 30 countries and the ability to select which individual server you're using within that country.

Unfortunately, both Hulu and Netflix were blocked when we tested CyberGhost,

which is a big black mark if you're looking to use it to avoid geoblocks. This was true for both the free and paid versions of the service.

Another black mark is the high cost of the service, especially if you want more than one device to use it simultaneously. And although it has a nice interface and a lot of useful extras like ad-blocking, site compression (for data reduction on mobiles), a SOCKS5 Proxy, PP2P/LT2P/IPSec support, a kill switch, IPv6 and DNS leak protection and even security-suite style web filters and HTTPS forcing (similar to HTTPS Everywhere), all that still doesn't justify the price tag.

Verdict

Lots of neat features, but too expensive and unable to access Hulu or Netflix.



USA - Los Angeles - 3

DISCONNECT

US\$12.95 MONTHLY; US\$99.95 ANNUAL | WWW.EXPRESSVPN.COM

ExpressVPN

Super-fast.

One of the largest VPN providers in the world, the US-based ExpressVPN is also one of the more expensive. It does, however, somewhat justify that high cost with extremely high speeds and fast response times. Pick the right server, and you can easily redline your connection over ExpressVPN, essentially taking zero performance hit when using it. There is some significant variability between servers — one server in LA, for example, only hit 5.09Mbps, while another hit 30Mbps. Ping times were good across the board, only 10-30ms higher than normal.

Being such a large target, however, has its problems. When we initially connected to the LA servers, both Hulu and Netflix were blocked. However, after opening a support window and chatting with ExpressVPN's support staff, we were told that the Denver and Washington servers remained unblocked. We connected, and lo, both

services worked perfectly. Of course, that may change by the time you read this, but it's definitely worth having a chat with them if you have problems (although we do think this is the kind of thing that should be posted on the ExpressVPN site).

The app itself is as simple as they get: pick your location (from a huge list of available options; fortunately it recommends servers based on load and proximity) and click connect. There's a kill switch option enabled by default as well as DNS leak protection, but it lacks some of the other more advanced features some VPNs offer like disabling IPv6. The site also has a host of well-written and clear guides for setting up VPNs on other devices.

Verdict

Pricy and frills-free, but worth it. Hulu and Netflix-capable.





\$16.99 MONTHLY; \$111.48 ANNUAL | WWW.HIDEMYASS.COM

HideMyAss! Pro VPN

Ass not hidden.

Another stalwart of the VPN scene, HideMyAss has an absurdly high monthly rate, but a much more reasonable annual rate. For that you get access to one of the most extensive VPN networks around, with servers in nearly every country that has internet access.

It also has the most advanced client application we've seen. There are lots of tools available here not seen on other services. The highlight is the automatic server recommendation system. When we tried to connect to the primary Los Angeles server, we were told that a different server has a lower usage right now and were asked if we'd like to connect (we did for the speed tests). There are also tools like random and periodic IP address switching and a conditional 'kill-switch' style tool that prevents certain applications from working if the VPN is down.

Unfortunately, even with the server recommendation system, the service did not do well in our speed test and

streaming from Amazon and UK services were riddled with pauses, stuttering and buffering. You'll likely have to switch several times to find a server with enough bandwidth to sustain solid video streams. Speedtest.net is your friend here.

It also did not do at all well in our tests against Netflix and Hulu. Both failed, and it doesn't seem that HMA is working to rectify the situation. Live chat couldn't help. Amazon did work, but both it and UK services were so slow speeds it almost didn't matter; you're going to struggle to watch anything.

Given the slow speeds, high monthly cost and inability to stream from major services, HideMyAss is not recommended. It does have a great app, but a great app is useless if the service isn't up to snuff.

Verdict

Great app, not a great service.



privateinternetaccess vpn settings

Username

Password

[Forgot password?](#)

☐ Start Application at Logon

☒ Auto-Connect When App is Started

Region

US West

Connection Type

udp

Remote Port

auto

Local Port

Port Forwarding

☒

[Port shown](#) in tooltip after connecting

VPN Kill Switch

☐

[Disable your internet](#) when VPN disconnects

DNS Leak Protection

☐

Prevent [leaking DNS](#) queries while on VPN

IPv6 Leak Protection

☒

[Disable IPv6](#) while on the VPN

Small Packets

☐

[Fixes issues on some networks](#)

US\$6.95 MONTHLY; US\$39.95 ANNUAL
WWW.PRIVATEINTERNETACCESS.COM

Private Internet Access

Once great, now mediocre.

A VPN service made popular by its low price, Private Internet Access has fallen far since it first rose to prominence a few years ago.

Its success has clearly been its own worst enemy, with notable performance issues on a number of streaming services. On UK services, buffering was a constant issue even in SD, which is not surprising given its extremely low Speedtest.net result of 0.57Mbps. It fared little better connecting to US West, with a download throughput of just 0.63Mbps. Even switching to other servers in the US provided no better results. The best that could be said is that its ping speeds were OK, only about 30ms higher than the baseline.

Given the low speeds, it almost doesn't matter that both Netflix and Hulu are inaccessible with the service. No amount of hopping between servers could find one that could access either streaming service.

Which is all a shame,

because we like its simple interface. It keeps no logs and supports exactly the right kind of security measures that you'd want, including a kill switch, leak protection and anonymous payment systems. It supports PPTP and L2TP for simple setup on third-party devices (though it uses a different password to your main password) and there are guides online for setting it up on a variety of devices – though it should be noted that some of those guides are horribly out of date. There's even a SOCKS5 proxy available as part of the account for those who just want to use it for anonymous BitTorrenting.

But all that doesn't make up for the poor speeds and inability to work around geoblocks. Even at the low price, this is not recommended.

Verdict

It may be cheap, but it's still not worth it.





TCP

UDP

0% | 160ms

Server down

Austria

0% | 50ms

Canada

0% | 138ms

France

8% | 66ms

US\$8 MONTHLY; US\$48 ANNUAL | WWW.NORDVPN.COM

NordVPN

Netflix guaranteed.

NordVPN is a newer service that promises to maintain support for Netflix even in the face of proxy bans. It also promises unthrottled BitTorrent usage and no logging at all. For the ultra-security conscious it even offers Tor over VPN and "double VPN," zero logging and anonymous payment options including Bitcoin.

When it comes to geoblocking, NordVPN keeps its promises. Not every server will foil Netflix and Hulu's anti-proxy tech, but at the time of writing there were seven countries for which Netflix was available: US, UK, Canada, Netherlands, France, Italy and Norway. You may have to contact support using the live chat function to get a list of the current servers that work with Netflix and Hulu. Although it's not entirely clear on the page, you can also visit nordvpn.com/servers, which lists servers by load and function, and look for the "Ultra fast TV" servers for servers that are likely to

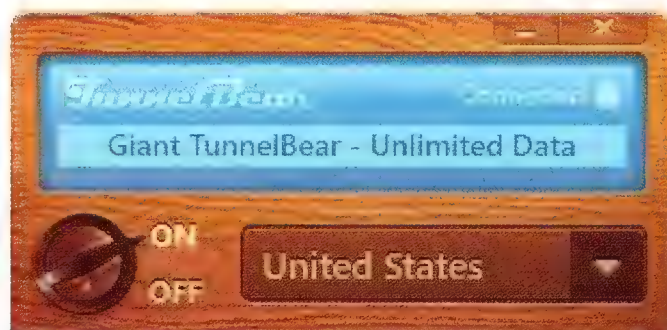
work with Netflix and Hulu. (We should note that these are not the only servers that work – contact support for a full list – but it's an easy way to get going.)

The service is supplied with a straightforward "select your server" app that handily lists the current load and ping times on each server, making the choice so much easier than the lottery you often have to endure with other providers. Behind the scenes it supports DNS leak protection and a kill switch, and the NordVPN knowledge base has a host of useful setup guides and help systems for all platforms.

NordVPN really does all the right things. It unblocks Netflix and Hulu, provides excellent speeds and the right security tools to ensure your privacy.

Verdict

This is the one. Affordable, capable, and you can use it with up to six devices at a time.



Safe and sound in an encrypted bear hug

Maul Trackers

OFF

Privacy

US\$7 MONTHLY; US\$50 ANNUAL | WWW.TUNNELBEAR.COM

TunnelBear

Cuteness overload and Netflix-capable.

TunnelBear is another popular provider that also offers a free service, but in this case that free service is volume-limited to 500MB per, which makes it less than useful for streaming purposes. If you want a streaming-capable service, you'll need to subscribe.

It's available as a browser extension or a (very cute) downloaded app. You don't get to choose the specific server you use, only the country, and the app has very few options besides that. It does have a privacy tool that provides tracker filtering similar to Disconnect.me. But there's no kill switch or DNS/IPv6 protection.

Given its lack of specific server options, there's not a lot of troubleshooting to be done if a given streaming service doesn't work. For us, connected to the US, Hulu did not work. Netflix somewhat surprisingly did work, but whatever technique or server TunnelBear was using to make Netflix happen was clearly heavily

overburdened. The Netflix playback suffered from long, long buffering times and was stuck in the lowest resolution playback. It still gets a technical pass, but be warned it's not the best experience.

For non-Netflix activity, however, the US service was snappy enough. Ping times were too high, being 123ms over the no-VPN control tests, but the throughput was more than acceptable. The UK struggled rather more, however, so don't expect to watch UK services in HD, or even in SD at times.

As one of the few services that will work with Netflix without the need for playing "find the magic server," TunnelBear gets respect, but has speed issues. Try the free version before handing over your credit card.

Verdict

Netflix capable, but barely.



Create a VPN router

For the ultimate in geoblock-busting, set up a second router as a VPN gateway for all your devices. Nathan Taylor

VPNs are great for both privacy and dodging geoblocks, but they do have limitations. For a start, not every device has a VPN client – your game console, smart TV set and media player probably don't have a VPN client app available. What's more, your VPN service provider might only accept a single connection at a time.

The solution to both these problems is setting up a dedicated VPN router. With a VPN router, any device connected to it will automatically be routed through the VPN. That includes consoles and smart TVs and anything else you connect to it. It only counts a single connection from the VPN provider's point of view, no matter how many devices you have connected to it.

THE PLAN

The best solution for most people is to put a secondary router in your home. You can leave your existing internet router in place (we'll be calling this the primary router from hereon in) and connect a second router to the primary router that's dedicated to providing VPN services. We'll call this the VPN router.

When this is done any device that you connect to the primary router – either physically through a wired connection or through Wi-Fi – will have regular internet service. Any device connected to the VPN router (again, either wirelessly or with wires) will be routed through the VPN. You can, of course, bounce devices between them as needed, just by connecting to different Wi-Fi networks.

Just the one router

It is, of course, possible to set your primary router up as a VPN router, so that all your data goes through the VPN. Most people probably don't want that, since VPNs do add latency and reduce internet speeds — sometimes you just want the fastest internet you can get.

WHAT YOU NEED

To make this happen, you'll need a second broadband router, one with an Ethernet WAN port (not an ADSL or cable modem router). We'll be installing special firmware on this router that lets you set it up as a VPN client. The router needs to be supported by DD-WRT, which is the name of the firmware we'll be using.

To check if a given router is supported by DD-WRT, head to www.dd-wrt.com and click on the Router Database. Perform a search for a router model name here, and a list will come up revealing whether the router is supported or not. If it is, you should be good to go.

BEFORE YOU START

Before we get started on the setup, there are a couple of things you should do:

- 1 Make a note of your primary router's LAN IP address (that's the one you use in a browser to access the router admin console). The examples in this tutorial are going to assume it's 192.168.1.1, but depending on your router model it could be 192.168.0.1, 10.1.1.1 or really any 192.168.x.x or

10.1.x.x variation.

- 2 Head to www.dd-wrt.com and search the Router Database for the model of router you're intending to turn into the VPN router. This is very important – each router model has unique setup instructions and a recommended DD-WRT build to download. Double click on the router model to see its page.

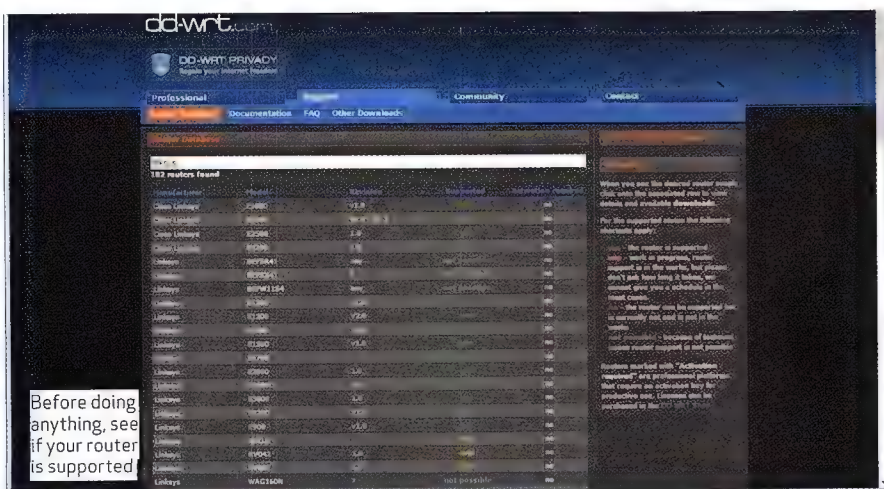
- 3 On the router page, you'll see a link to the DD-WRT Wiki page for that router. Click on it. This will take you to an instruction page for setting up the router. We'll need to keep this page open and follow its steps carefully. Give it a read through now.

- 4 The Wiki page should also have a link to a recommended DD-WRT

Pre-flashes

If installing DD-WRT on a router seems too much for you, it's absolutely possible to buy routers pre-flashed. Many VPN services providers will sell them directly, and there are online sellers like FlashRouters (www.flashrouters.com) that will sell pre-flashed routers. There's also a small but growing number of consumer routers that don't need to be flashed because they have a VPN client built in.

New ASUS routers have a VPN client built in.



superguide » Create a VPN router



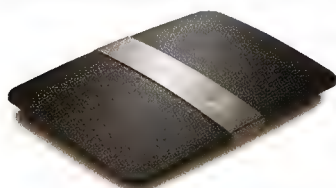
The WAN port on the VPN router connects to a LAN port on the primary router.



Linksys E4200

Contents (new)
1 Hardware Specifications
2 Flashing
2.1 Warnings
2.2 Flashing Process
2.3 Upgrading Process
2.4 Reverting back to stock firmware
3 Wireless N Configuration
4 References

Hardware Specifications



The DD-WRT Wiki is essential.

build. This will be a .bin file that you need to download to your PC. This is what we'll be using to flash the router. Depending on your router, you may also need to download additional tools, like a TFTP app.

PHYSICAL CONFIGURATION

Now to plug your VPN router in. Grab an Ethernet cable and connect the WAN (internet) port on the VPN router to any LAN port on the primary router. It looks like this:

INSTALLING DD-WRT

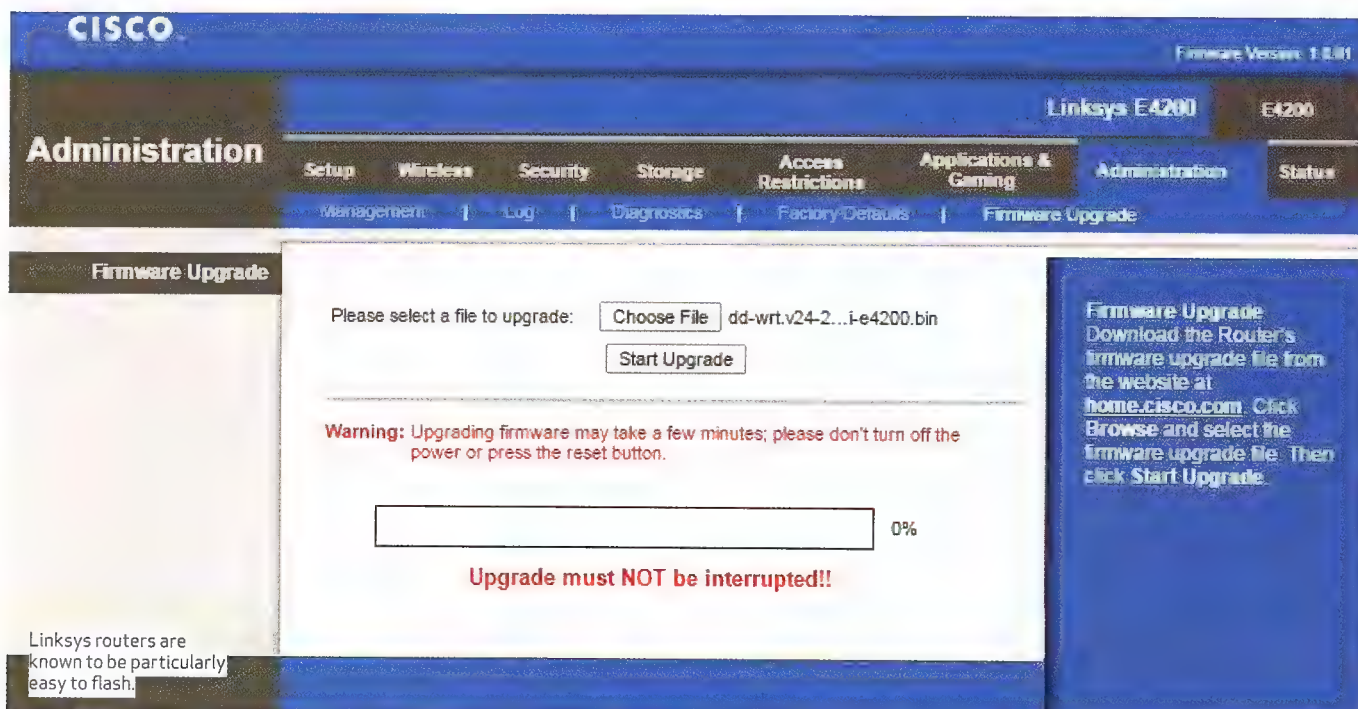
The router page from the DD-WRT Wiki has the exact instructions on how to flash your router. If you're lucky, it essentially goes:

1 Perform a 30/30/30 hard reset on the router. This means, while the router is power on, press and hold the reset button for 30 seconds. Then, still holding the button, turn the power off and wait 30 more. Then (again, still holding the button) turn the power on and wait another 30.

2 Log into the router's admin page and go the firmware upgrade section (usually found under administration). Use the file option, and select the .bin file you downloaded from the DD-WRT Wiki. Click start.

3 Wait a few minutes while it updates. Then perform another hard reset.

If you're not so lucky, you may have to perform some arcane hoodoo to put the router into debug mode. Again,



Linksys routers are known to be particularly easy to flash.



Wireless Physical Interface wlo [2.4 GHz]

Physical Interface wlo - SSID [Cisco01125] HWAddr [C0:C1:C0:F4:B4:76]

Wireless Mode:

Wireless Network Mode:

Wireless Network Name (SSID):

Wireless Channel:

Channel Width:

Wireless SSID Broadcast: ☒ Enable ☐ Disable

Sensitivity Range (ACK Timing): (Default: 2000 meters)

Network Configuration: ☐ Unbridged ☒ Bridged

Wireless Physical Interface wl1 [2.4/5 GHz]

Physical Interface wl1 - SSID [Cisco01125] HWAddr [C0:C1:C0:F4:B4:77]

Wireless Mode:

Wireless Network Mode:

Wireless Network Name (SSID):

Wireless Channel:

Channel Width:

Wireless SSID Broadcast: ☒ Enable ☐ Disable

Sensitivity Range (ACK Timing): (Default: 2000 meters)

Network Configuration: ☐ Unbridged ☒ Bridged

Set up wireless just like you would on a normal router. Don't forget to click on the security tab (it defaults to none) to configure WPA2.

Network Setup

Router IP

Local IP Address:

Subnet Mask:

Gateway:

Local DNS:

Set the local IP address of the VPN router to the same as your primary router, except for the third number in the quartet.

follow the DD-WRT Wiki instructions very carefully, or you risk ruining the router!

INITIAL SETUP

Hopefully the router flashed successfully. Now it's time for some basic setup tasks. The default IP address of DD-WRT is 192.168.1.1. Open your browser, and enter that IP address into the address bar. The default username is root, password admin. You should see the DD-WRT interface.

NOW FOR SOME BASIC SET-UP TASKS:

1 Set up wireless. Click on the wireless tab. You'll need to set up the wireless access point with its own unique SSIDs – just like you would a regular router. Setting up wireless allows you to quickly switch between the primary and VPN router by just changing Wi-Fi networks.

2 Set LAN settings. We don't want the LAN address of the of the VPN router to conflict with that of the primary router, so we may need to change it. Under Setup > Basic setup, find the section Network Setup/Router IP. Change the IP address of the VPN router so that it doesn't conflict with the primary router.

A good way to do this is to set it so that the third of the four numbers in the IP address is different (it can be anything between 0 and 255). For example, if your primary router's IP address is 192.168.1.1, you can set the VPN router to 192.168.2.1. If the primary router is 10.1.1.5, you could set the VPN router to 10.1.2.5 and so on. Then click Save.

3 Set the router up as a client on your primary router. Your VPN router is plugged into a port on your primary router – which thinks it's just another device on your network. On the main Setup/Basic Setup page you can set the WAN Connection Type. The default is DHCP, which is actually fine. But if you like, you can also switch to Static IP Address, which is just like setting up a static IP address on any other device on your network:

- The WAN IP address is the local address of the VPN router (the first three numbers should be the same as your primary router, but the fourth should be different; for example, if your primary is 192.168.1.1, you could set the VPN router to 192.168.1.20).

- The subnet mask is 255.255.255.0.
- The Gateway is the IP address of your primary router (eg. 192.168.1.1).
- The Static DNS is the DNS server addresses for your ISP.

You'll see the value of a static IP address in the final section of this article, when we talk about connecting the networks.

superguide » Create a VPN router

Whether you go static or DHCP, make a note of the WAN IP address of your VPN router. It's there at the top right of the DD-WRT interface. You may need it later.

Just to check that everything is in working order, try to access the internet while connected to the VPN router. It should work now.

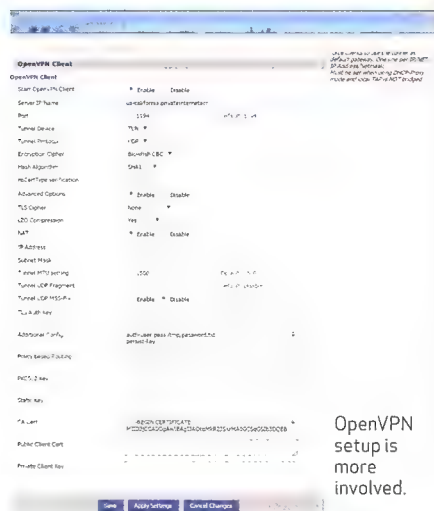
SETTING UP THE VPN

Righty, now it's time to finally set up the VPN on the VPN router.

You'll need to head to your VPN provider's home page. It will have details and guides that you'll need to set up the VPN on the router. Most will have a guide for DD-WRT setup.

Typically you can set it up using either PPTP or OpenVPN, which are similar VPN technologies. OpenVPN is a little more secure, but it's also more difficult to set up.

Setting up PPTP primarily requires a server address provided by your VPN provider, which may include a list of servers by country, and you choose the one that you wish to appear to be from. You'll also need your VPN username and password – note that for some providers, like PIA, the PPTP username/password is distinct from the general username/password.



OpenVPN setup is more involved.

PPTP Client

PPTP Client

PPTP Client Options

Server IP or DNS Name

☒ Enable ☐ Disable

pptp.vpnprovider.com

Remote Subnet

192.168.1.1

Remote Subnet Mask

192.168.1.1

MPPE Encryption

require-mppe

MTU

1436 (Default: 1436)

MRU

1436 (Default: 1436)

NAT

☒ Enable ☐ Disable

Username

myvpnusername

Password

..... ☐ Unmask

PPTP setup is easiest.

WAN Connection Type

Connection Type

Static IP

WAN IP Address

192.168.1.25

Subnet Mask

255.255.255.0

Gateway

192.168.1.1

Static DNS 1

0.0.0.0

Static DNS 2

0.0.0.0

Static DNS 3

0.0.0.0

Setting up a static IP address.



I see no VPN settings!

If you can't see VPN settings in the DD-WRT interface, don't worry. Some of the recommended DD-WRT builds don't have it. Just head back to DD-WRT.com, and find your router in the database. It will show you alternate firmware builds with downloadable .bins for each. Look for a "big" or "OpenVPN" build and download it, then go to 'Administration > Firmware Upgrade' in DD-WRT and install it.

Now head to Services > VPN in DD-WRT and enable the PPTP Client. Enter the details supplied by the VPN provider in the box.

For OpenVPN, you'll usually have to copy and paste some scripts and certificates supplied by the VPN provider. Head to the provider's support page and look for the DD-WRT/OpenVPN setup guide. You'll need to follow it closely.

Once you've done that, reboot the router. When it starts up again, if the VPN client connected correctly, your WAN IP address should have changed. It's now your VPN IP address. Congrats! You've connected your router to the VPN.

Now that you have the VPN set up on your VPN router, you can call it a day if you like. Any device connected to the

VPN router – wired or wirelessly – will automatically be connected to the VPN. Geo-blockers beware.

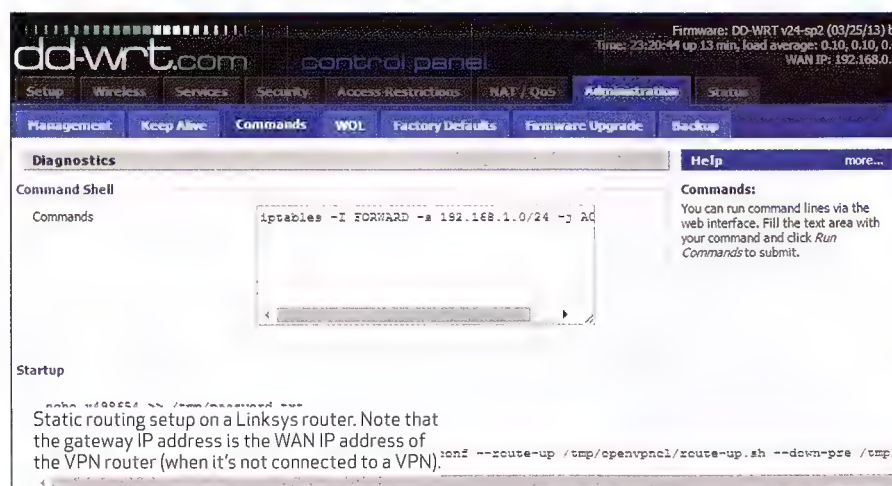
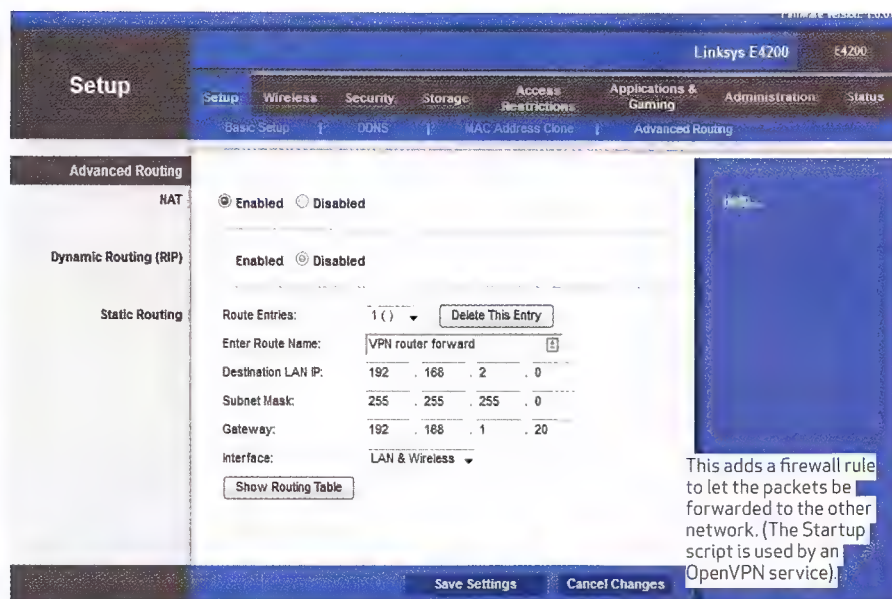
If you're prepared to dive into the weeds a little, however, there's more you can do. This next part is optional, but can solve a serious problem on some home networks.

GETTING THE NETWORKS TO TALK TO EACH OTHER

With this configuration one problem that you'll face is that you have what are effectively two discrete LANs. Devices connected to the primary router may not be able to talk to devices connected to the VPN router. For most devices that isn't really a problem (they still have internet access), but if you have home servers like network attached storage devices you can run into issues.

Before you do anything, first try to connect to devices attached to the other router. In theory 'upstream' connections – connecting from devices attached to the VPN router to devices attached to the primary router – should just work, so servers like NAS devices should generally be connected to the primary router. (Many NASs also have multiple Ethernet ports. Here's where you can make very good use of them, connecting one port to each router, thus giving devices attached to either access to the NAS.)

It's primarily in connecting the other way, from the primary to VPN router, that you'll run into problems.



A more complete solution is to configure forwarding on both the primary and VPN routers so that data goes between them properly. This can be a little mind bending, so you need to pay close attention.

Let's start with the VPN router. We need connections from a primary router IP address to make it through the firewall. Connect to the VPN router and enter the admin interface.

Click on Administration, then on the Commands tab. In the Command Shell box, enter this line:

```
iptables -I FORWARD -s
192.168.1.0/24 -j ACCEPT
```

Then click on the Save Firewall button. (For those who are interested, iptables is a Linux command controlling firewall packet filtering rules).

This is assuming you have a 192.168.1.x address for your primary router. If it has a different address, you need to change the IP in that line to that the first three numbers are the same as your primary router – but the last number will always be 0. For example, if your primary router's LAN IP address is 192.168.5.50, the line

would instead be:

```
iptables -I FORWARD -s
192.168.5.0/24 -j ACCEPT
```

One other thing you should do while connected to the VPN router: go to Administration > Management and enable the radio button for Web GUI Management. This will allow you to access the DD-WRT administration interface when you're connected to the primary router (it normally won't let you for security reasons).

Now for the other side. The idea here is to get all connections to a VPN router IP addresses to be sent to the VPN router. For example, say your VPN router's IP address is 192.168.2.1. Any device connected to it will have an IP of 192.168.2.x, so we want all attempts to connect to 192.168.2.x to be forwarded to the VPN router (which now has an open firewall for such connections). We do this using a router tool called static routes.

Connect to the primary router and log onto the admin interface. You'll have to find the Static Routes section – it's usually under Advanced Routing. You have to create a new rule that will

make any data destined for LAN addresses on your VPN router's network to be forwarded onto the VPN router. Follow these steps:

- 1 Give it a name. This is simply an identifying label for the rule. It can be anything.
- 2 Set the destination IP address as 192.168.2.0 (this assumes that your VPN router has an IP address of 192.168.2.x – as above, if it has a different address then the first three numbers are the same as you VPN router's admin console LAN IP address – but the last number will always be 0, which is a wildcard here. For example, if your VPN router's address is 192.168.10.50, then the number entered would be 192.168.10.0).
- 3 Set the subnet mask to 255.255.255.0.
- 4 Set the gateway IP address to the WAN IP address of the VPN router.

Now this is tricky: remember how we asked you to make a note of the WAN IP address of the VPN router before it was connected to the VPN? We need that number. If you didn't make a note, then connect back to the VPN router and disable the VPN service. The WAN IP number should change to be the number we need. Remember that the WAN IP address of the VPN router is actually a LAN IP address of the primary router, since the VPN router is actually connected to a LAN port on the primary router. Confused? We told you this would be mind bending! As an extra note, if you set the VPN router up with DHCP, its address might change at times, so you'll need to modify this rule if it does.

- 5 Save the route. Now that's set up, you can test it. While connected to the primary router, try to access the management console of the VPN router (this won't work unless you've enabled Web GUI on DD-WRT). Then switch around: connect to the VPN router and try to access the management console of the primary router. Hopefully it should work both ways.

Even with static routing set up, you'll still likely experience some wonkiness when you try to access devices across networks. For example, network discovery scans likely won't work across routers, so you won't be able to auto-detect media servers when using DLNA or file servers using the Network browser in Windows Explorer. To connect to them you'd have to manually Map Network Drive using the IP address of the file server.

Unfortunately, unless you want to get really sophisticated and use VPN client/server technology to connect the routers or bridge the LANs with an Ethernet cable and set up a complex set of static IPs and routes (which are both possible, but beyond most users) that's something you'll have to live with. ■



USB Type-C: the gear is here

The USB plug has been upgraded — but where's all the gear to go with it? We set Lindsay Handmer to track down 10 new USB-C devices.

The traditional USB port (technically called USB Type-A or just USB-A) has been around for over 20 years now, along with a range of other micro and mini connections in more recent times. As the USB spec has improved, the old connectors eventually could not keep up with the power and data requirements. USB Type-C (USB-C) is the answer — a small, robust, reversible connector that can be used on everything from phones to laptops. Not only can it handle extras such as video output, it can also transfer higher power levels, to charge

laptops. USB-C is starting to become common on laptops, motherboards and phones, and there is a range of peripherals to take advantage of the new ports.

The spec and naming of USB-C can be confusing, as there are a few options. USB 3.0 spec gives 5Gbps transfer speeds, but it's sometimes also called USB 3.1 Gen 1. USB 3.1 Gen 2 (mostly just called USB 3.1) gives up to 10Gbps transfer speeds. For now, most peripherals are rated for 5Gbps, which is typically much faster than whatever device is transferring data anyway.

The 12-inch MacBook famously

launched last year with just one USB-C port, used for peripherals, data transfers and charging. For many users then, adding extra connectivity to a device with USB-C will be essential, and the better hub options also allow pass-through charging.

It's worth noting that USB-C cables are active devices, which negotiate for safe power levels during operation. Due to the higher power capabilities of USB-C, if a cheap or incorrectly-wired cable or adaptor is used, there's a chance you could damage your device.



✓✓✓
apc
RECOMMENDS

\$29.95 | WWW.BELKIN.COM/AU

Belkin USB-A to USB-C

When quality cabling matters.

A simple cable by itself might not seem exciting, but going for a cheap upgrade can have expensive consequences. Surprisingly, after spending over \$1,000 on a new smartphone (or even more on a laptop), some people still opt for that ultra-cheap \$2 eBay cable. It's not super common, but a dodgy wire can destroy your tech — as one Google engineer found out when testing low cost cables. The standard USB (Type A) to USB-C cables are the biggest risk, as the older style connector might not be set up correctly to handle the potential extra current draw from the USB-C end.

Fortunately, Belkin has the answer, with a range of high quality USB-C cables you can trust. We tested USB-A (male) to USB-C, as well as USB-C to microUSB. Additionally, the cable options are USB-C to USB-C, USB-C to USB-B, USB-C to Mini-B, USB-C to Micro-B,

and USB-C to USB-A (female).

Both the cables tested are 2M long — which is a handy upgrade over most that are supplied with new devices. They are rated for USB 2.0 speeds, rather than USB 3 (though there is a 3.1 spec cable for a higher price), and are more focused on charging.

We tested the Belkin USB-A to USB-C cable on the new Huawei P9 smartphone, for both charging and data transfers. The quality is excellent, and the connectors plugged in and out with no issues, and charged the device at the same rate as the factory cable. Data transfers gave the same result — with no speed difference using the Belkin product.

Verdict

A high quality cable that's actually worth the extra cost.



\$75 | WWW.BELKIN.COM/AU

Belkin 4-Port USB-C Mini Hub

Connect your extra devices when on the go.

USB-C is great, but it is not yet universal enough to replace all your peripherals. The Belkin hub expands the available options, by turning one USB-C connection into multiple ports. Rather than opting for one or the other, the hub has two USB-C connections, as well as two normal Type-A ports. It's rated for 5Gbps transfer rates, so can easily handle the full speed of most external drives. The Belkin hub is designed for travel, and the enclosure won't scratch other devices easily. It also has a built-in recess for the cable, which can be tucked completely away. The whole thing measures in at 98 x 16 x 88mm and weighs 81 grams.

In testing, the Belkin hub happily provided full bandwidth to our flash drives, and could power USB HDDs. The USB-C connection cable is a little short though, but not enough to limit its use. The

hub is fully compatible with any USB-C port, and does not need any drivers. That said, official support (at this stage) is only for the MacBook and Chromebook Pixel.

The biggest flaw (albeit mostly for MacBook users) is that the Belkin hub does not support pass through charging. This means that any time the hub is plugged in, you need to be running on battery power, including when charging a tablet. It also limits any peripherals connected to the hub to 900 mAh overall, whereas powered hubs can handle up to 3A. Of course, devices with more than one USB port don't have this issue.

Verdict

A handy and compact travel hub, but be aware it does not support pass through charging.





\$59.95 | WWW.JAYCAR.COM.AU

Jaycar USB-C to HDMI Converter

Explore your device's video output options.

USB-C is more than just an easy-to-use connector, and can transfer video on compatible devices. To take advantage of that, Jaycar has a USB-C to HDMI converter, allowing you to feed video out to another screen. The adaptor can handle resolutions up to 4K, using USB 3.0 and HDMI V1.4B spec. It does not need drivers either – just plug in and go. The business end measures in at 43 x 43 x 13mm (plus a short cable), and is easy to slip into a bag. Whilst ditching the HDMI port in favour of the smaller USB-C connector doesn't mean much for larger devices, it can save a lot of space for ultraportable laptops and tablets.

The problem with USB-C to video is that for now, not many devices actually support it. Just because you have a USB-C port, doesn't mean the underlying hardware can do anything other than charge and transfer data. The Apple

Macbook and Chrome Pixel were amongst the first, and there are a range of other devices, from laptops, through to tablets and even desktop motherboards.

For those with a taste for other video formats, Jaycar also has a USB-C to DVI converter, and even an option to output old-school VGA. Both the devices are rated for 1080p resolutions at up to 60Hz. They share identical dimensions as the HDMI model, and cost the same too.

While it is possible to find cheaper converters online, the Jaycar model is worth the price, knowing that is has been properly tested and vetted, and comes with a warranty.

Verdict

Easy video output for compatible ultraportable devices



\$55 | WWW.J5CREATE.COM

J5 Create JCH471

A range of USB-C connectivity.

Extra USB-A ports are always handy, but sometimes other options are also useful. The J5 Create hub adds a Gigabit Ethernet connection, all over a single USB-C port. The Hub also has three standard USB Type-A connections, for all your other peripherals.

These days Wi-Fi is fairly ubiquitous, but just everyone has experienced the pain of a bad connection. Worse, most modern ultra slim laptops don't actually have LAN ports anymore, leaving you at the mercy of the wireless gods. For those who travel a lot, hotel rooms are a perfect example. Wi-Fi issues abound, and when busy, speeds can slow to a crawl. But most large hotels (especially though aimed at business travellers) also have wired network connections, which can offer much faster and more reliable connections. The J5 create makes it easy to add LAN connectivity to a laptop, while also giving a

bunch of extra USB ports. For those who want a slimmer adapter, there is also a LAN-only model.

Unlike a straight-up hub, the j5 create needs drivers installed before a network connection is possible. A driver CD is included in the box, but a simpler option is to just download it from directly from www.j5create.com. It is compatible with Windows, Mac OS, Linux and Chrome OS.

In use, the JCH471 gave USB 3.0 transfer speeds identical to being plugged the computer directly. The Gigabit Ethernet connection also performed well, and easily maxed out the transfer speeds on our test NAS.

Verdict

A high speed USB 3.0 hub and LAN adapter in one.





\$40 | WWW.KINGSTON.COM

Kingston DataTraveler microDuo 3C

Why settle for just one connector?

For now, USB-C is not common enough to throw caution to the wind and become your only connection method. But for those who are sick of always plugging in their USB flash drives upside down, Kingston has a better option. The DataTraveler microDuo opts for a standard USB-A port on one end, but has USB-C on the other. This gives the best of both worlds, as you can take advantage of the new connector where available, but still have total backwards compatibility with other devices. The drive also supports OTG, which means you can plug it into a smartphone and copy files directly.

The microDuo is absolutely tiny in hand, and measures in at just 30 x 17 x 9mm. The drive is available in 16GB, 32GB and 64GB capacities, and all are rated for USB 3.1 connections. The USB-C side of the drive is protected by a swivelling rubberised cover – though in

some cases, it can get in the way when used around other occupied USB ports. For those who don't yet have USB-C, there is also a microUSB version.

We tested the 64GB capacity, using both a Huawei P9 smartphone, and a USB-C equipped ASUS motherboard. Read and write speeds are the same for either end, but are not quite as good as you might hope. The problem is not USB-C, but rather the underlying flash and controller can only manage 98MB/s reading, and 14.1MB/s writing.

Handily, Kingston backs the drive with a nice long five-year warranty.

Verdict

Especially useful for those who want USB-C OTG functionality.



\$250 (2TB MODEL AS TESTED) | WWW.LACIE.COM

LaCie Porsche Design Mobile Drive

Upgrade to a stylish USB-C drive.

Just about every USB powered accessory can benefit from the new Type-C connector, so it is no surprise to see it cropping up on the new LaCie portable drive. The shiny metal enclosure itself sports the USB-C port, and in the box is both a USB-C to USB-A cable, as well as USB-C to USB-C. This setup gives a range of advantages, whilst also retaining full backwards compatibility with non-USB-C equipped PCs. Not only is the connector itself a lot smaller and more robust than USB3.0 spec microUSB, it much easier to plug in. The Porsche part of the HDD is in the design, which feels very sleek, if somewhat angular in the hand.

The LaCie drive itself comes in 1TB, 2TB (as tested) and 4TB models, using a 2.5" mechanical drive inside. The two smaller capacities measure in at 84 x 128 x 10mm and weigh 193 grams, while the 4TB drive is 21mm thick, and 320 grams.

The main LaCie drive comes unformatted, and includes an assistant (when plugged in) that helps you set it up as either FAT32 or NTFS. It is rated for USB 3.0 5Gbps speed, but in practice, the drive itself manages 127 / 118 MB/s read / write speeds.

On the drive, LaCie has included a backup assistant, which can help automate the process. For the security conscious, it also supports AES 256-bit encryption, but needs a separate software download to set it up.

The 1TB model is priced at \$185, 2TB \$250 and 4TB costs \$390.

Verdict

A stylish and fairly fast portable HDD that maintains backwards compatibility with USB-A.





\$99 | WWW.MINIX.COM.HK

Minix NEO C Multiport Adaptor

Expand your connectivity options.

For those who don't want to have to choose between different USB-C adaptor options, the NEO C includes all the most useful. For a start, it has dual USB 3.0 spec Type-A ports, for all your existing USB peripherals.

On the same side, it also has full size and microSD card readers, for copying files such as camera images. On the end, the NEO C has a Gigabit LAN port, for wired network connectivity. On the other side, the versatile adaptor has an HDMI port, which can output 4K video. It also has a USB-C port, which can handle pass-through charging to laptops such as the Apple MacBook. Plugging in a charger also boosts the amount of power available to the USB ports, which is useful when running external drives.

The NEO C is solidly built from aluminium, but the abrupt edges could easily scratch up other devices if left together in a bag. The multi-use hub comes in

three colours – rose gold, silver and space grey. For those who need old-school video connectivity, there is also a versions with 720p VGA output instead of HDMI. The hub is rated for 3.0 speeds, and could happily max out the transfer speeds on our USB drives during testing.

While marketed towards Apple users, the hub's built in USB cable means it is easy to use with any USB-C equipped device. Unfortunately at this stage there is only a network driver available for Mac OS, not Windows or Linux.

Verdict

A versatile hub option best suited to MacBook users.



\$85 | WWW.ANYWARE.COM.AU

Promate MacHub-12

Get those extra ports you crave.

The super slim MacBook is an amazing bit of engineering that has adopted USB-C wholeheartedly. In fact, for some users, it's a little too far, as the computer only has a single USB-C port, which it also uses for charging. That means if you want to use the laptop to copy files from USB, charge a tablet, output video and more, you can't charge it at the same time.

Not surprisingly, there are quite a few options available to add in extra functionality. The Promate MacHub-12 is designed for use with a MacBook, with a slim, aluminium clad form factor which mimics the laptop's build, and comes in silver, grey or gold. It can be used with any other USB-C ports as well (such as other laptops), but the design and shape limits the potential applications.

The Promate takes a single USB-C port, and splits it into dual USB 3.0 Type-A connections, as well as a

micro and full size SD card reader. It is rated for 5Gbps speeds, for fast file transfers. The hub also includes a USB-C charging port, so you can keep your MacBook juiced up while using USB devices. That power can also feed into the hub itself, to help provide extra current for charging tablets, or other devices. In testing, we also found that the Promate hub passes power from the external USB-C port, even when not plugged into a computer. This means you can use it as a splitter to charge two devices at once, completely independently to a MacBook.

Verdict

A simple and robust way to upgrade your MacBook.





US\$349 | WWW.SEAGATE.COM

Seagate Innov8

Power-free desktop USB storage.

The name might suggest this is a gimmick, but this Seagate HDD really is innovative. One of the major advantages of USB-C is the ability to transfer loads of power, to run all sorts of peripherals. Desktop portable HDDs usually need separate power supplies, but the Innov8 functions with just a USB-C cable. Seagate claim this is the first USB-only desktop HDD, and it uses a special internal battery to handle the higher loads of start-up.

In the box it comes with a single short USB-C to USB-C cable — there is no (official) backwards compatibility with USB-A, though it worked fine with a Belkin USB-A to USB-C cable. The drive itself has just one capacity — a fairly massive 8TB. It's clad in a very high quality aluminium enclosure, with heatsink style fins. The unit measures in at 208 x 124 x 36mm and weighs a very hefty 1.5 kg. Importantly, it

is rated for USB-C 3.1 spec, which allows for up to 100W of power transfer. It also means 10Gbps transfer speeds, but in the Innov8's case, the actual mechanical HDD inside the enclosure is the limit.

We tested on a USB-C 3.1 equipped ASUS motherboard, and managed to hit 201 / 162.1 MB/s read / write speeds — a pretty good result for a desktop drive.

The Innov8 won't be available in Australia until later in the year, and there is not yet an official price. Based on international pricing of USD \$349, expect to pay top dollar.

Verdict

A pricey drive well suited to the latest laptops, but with limited options for older PCs.



\$45 | WWW.ANYWARE.COM.AU

WaveLink USB Type-C 3.1 Hub

Another way to expand your ports.

USB Hubs are awfully handy, especially for use with laptops that may not otherwise give the desired number of ports. The WaveLink takes your USB-C connection and turns it into three standard USB-A ports, as well as another USB-C socket. The hub presents itself as a USB 3.1 device, but that is about compatibility, not speed. For file transfers, it can handle USB 3.0 spec speeds of 5Gbps, as well as being fully backwards compatible with slower USB 2.0.

The hub comes with a 5v PSU, which helps supply extra current (up to 4A) to power hungry devices. To make sure anything plugged in stays safe, the WaveLink has overcurrent detection on all the downstream ports.

The hub itself is made from high quality aluminium, and measures in at 185 x 35 x 16mm (plus the cable). It does have a few sharpish edges though, so is worth putting into its own

bag pocket when travelling to avoid it scratching your other pieces of gear.

The hub is plug and play for Windows, Linux and Mac OS, and does not require any special setup. We tested on an ASUS ROG Maximus VIII Hero Alpha motherboard, and could easily max out the transfer speeds on our Samsung T1 portable SSD.

One useful aspect of the WaveLink is that it can operate as a USB charger even when not plugged into a computer. It's worth noting though that power can't flow the other way, so the WaveLink cannot charge the device it is plugged into.

Verdict

An easy way to add extra USB ports to your Type-C device





WINDOWS 10 COMMAND-LINE TRICKS

GET SAVVY WITH THE COMMAND PROMPT,
WITH HELP FROM NICK PEERS.

The Windows Command Prompt is at once both powerful and often overlooked. It harks back to the days of DOS and the command-line, and continued to play a major role in early versions of Windows. Over time, it's been forced into the background, as Microsoft has pushed bells and whistles, but the Command Prompt has never been ignored, and continues to play an important role, particularly when troubleshooting.

The big headlines may have gone to the new Windows 10 user interface, or some of its more crowd-pleasing features, but the Command Prompt has continued to be nurtured by the Microsoft boffins, and Windows 10 introduced a number of handy improvements to the console window, making it more accessible and easy to use.

You can now resize the console window more easily, simply through drag-and-drop — no more

messing about with console buffer size settings (although you still can, if you prefer). Word wrap means text doesn't get lost off-screen, forcing you to horizontally scroll to read particularly long lines of text. You can now easily select parts of the console output with your mouse, and copy them to the clipboard with just one click (or, more precisely, one right-click). There are even useful new text selection key combinations, helping speed things up further, too.

But even without these handy new features, the Command Prompt remains a powerful and vital tool in any self-respecting PC user's armory. So why let Linux and Mac have all the fun with their Terminals when you can give your computer some command-line love in Windows, too? Join us as we dissect the Command Prompt, and reveal how best to make use of it. You'll never look at your mouse (or the Windows desktop) in quite the same way again.

Access to the Command Prompt is easy. If you don't need administrator-level access, press Windows-R, type cmd, and hit Enter, or search for cmd in the Cortana search box. Alternatively, right-click the Start button, where you'll find two options: 'Command Prompt' and 'Command Prompt (Admin)'. The latter launches Command Prompt as an administrator, giving you access to the full gamut of options.

Once the window opens, you'll find yourself staring at the Windows command-line, which will be a familiar sight to those who remember DOS, or who have had experience with the Linux shell. In the past, the Command Prompt was strictly a keyboard-only affair, but with Windows 10, Microsoft has added some mouse-selection features, it has expanded the way you can select, too. For example, hold Shift and use the arrow keys to select characters to the left and right, or lines up and down. Use Shift-Home and End to extend selections to the margin, and Shift-PageDown or PageUp to select entire screens. Throw in Ctrl with each of these shortcuts (so Ctrl-Shift), and the selection goes further — words, paragraphs, and even the entire screen buffer.

Before going any further, check out the box on customizing the Command Prompt interface, on page 71. By default, text is rendered quite small, so you'll be pleased to learn you can customize most aspects of the window — font, size, color, background, and so on.

What can you do with the Command

```
Administrator: Command Prompt
D:\Nick>cd ..
D:\>dir
Volume in drive D is Data
Volume Serial Number is 7D4F-5BF0

Directory of D:\

25/11/2014  11:55    <DIR>          Comodo
10/03/2016  18:56    <DIR>          Nick
02/06/2014  16:27    <DIR>          partition-backup
06/08/2015  12:55    <DIR>          ProgramData
08/03/2016  14:22                0 Recovery.txt
02/07/2014  12:00    <DIR>          ROMs
               1 File(s)                0 bytes
               5 Dir(s) 12,756,156,416 bytes free

D:\>cd:
C:\Program Files>cd ..
```

You can quickly and easily switch folders

"Even without these handy new features, the Command Prompt remains a powerful and vital tool in any self-respecting PC user's armory."

Prompt? There are dozens of useful commands you can input, and we're showcasing the best of them in this guide. Before continuing, though, it helps to understand how commands are broken down, known as the command syntax. There's the command itself, of course, but it's usually followed by a number of options, some compulsory (in that you

must choose at least one), others optional. These options are context-sensitive — they might refer to a path or filename, as is the case with the recimg command for creating a recovery image, or they may refer to various 'flags', which instruct the command to work in a specified way—for example, adding -v to a command, such as driverquery, usually

System File Checker

One of the best-known Command Prompt tools is System File Checker (SFC), and most know that typing `sfc /scannow` should, in theory at least, detect any corrupt system files and replace them with working backups. It's not always successful in repairing all files — if you get a message telling you that Windows Resource Protection was unable to fix all the corrupt files it found, try the following.

First, generate a text file with the information required to track down the files SFC couldn't fix:

```
findstr /c:"[SR]" %windir%\
Logs\CBS\ CBS.log
>"%userprofile%\Desktop\
sfcdetails.txt"
```

Now open the sfcdetails.txt file — this is a filtered view of the CBS.log, containing only those files SFC couldn't fix. Identify the corrupt files, and source working versions from another PC that's running the same version of Windows. Now issue the following commands for each corrupt

```
C:\Windows\system32>sfc /scannow

Beginning system scan. This process may take some time.
Beginning Verification phase
Verification 100% complete.

Windows Resource Protection found corrupt files but was unable to fix some of them. Details are included in the file C:\Windows\Logs\CBS\CBS.log. (Source: sfc)
Supported in offline servicing: No

C:\Windows\system32>findstr
file%Desktop\sfcdetails.txt"

C:\Windows\system32>

2016-04-29 19:43:01, Info CSI 000054d9 [SR] Cannot repair member file [L:11]"Wordpad.lnk" of Microsoft-Windows-wordpad, version 10.0.10586.0, arch amd64, nonSxS, pkt {1:8 b:31bf3856ad364e35} in the store, hash mismatch
2016-04-29 19:43:01, Info CSI 000054da [SR] This component was referenced by [L:165]"Microsoft-Windows-Client-Features-Package-AutoMerged-shell-31bf3856ad364e35-amd64~10.0.10586.0.Microsoft-Windows-Client-Features-Package-AutoMerged-shell-Deployment"
2016-04-29 19:43:01, Info CSI 000054dd [SR] Could not reproject corrupted file [L:68 ml:69]"??\C:\ProgramData\Microsoft\Windows\Start Menu\Programs\Accessories\Wordpad.lnk"; source file in store is also corrupted
2016-04-29 19:43:02, Info CSI 000054df [SR] Repair complete
2016-04-29 19:43:02, Info CSI 000054e0 [SR] Committing transaction
2016-04-29 19:43:02, Info CSI 000054e5 [SR] Verify and Repair Transaction completed. All files and registry keys listed in this transaction have been successfully repaired
```

file, replacing `<path>` with the file's path (such as `C:\Windows\System32`), and `<corruptfile>` with its full filename (jscrip.dll) takenown /f
<path>\<corruptfile>
icacls <path>\<corruptfile>
/GRANT ADMINISTRATORS:F

Finally, copy the file you took from the

other PC into the same folder, overwriting this one when prompted:

```
copy <sourcepath>\<sourcefile>
<path>\<corruptfile>
```

Run SFC again, which should now verify there are no corrupt files that require replacing. For more information, see support.microsoft.com/kb/929833.


```
Administrator: Command Prompt
D:\Nick\SkyDrive\Pictures\Family history>cd pink
D:\Nick\SkyDrive\Pictures\Family history\Pink>tree
Folder PATH listing for volume Data
Volume serial number is 7D4F-5BF0
D:
├── Annette
│   └── 04.10
├── Australia
│   └── 04.10
│       └── Unedited
├── Dorothy
│   └── 90th birthday
├── Howells
├── Jean
├── Maria
├── Percy
│   └── World War I
```

The "tree" command provides a hierarchical view of any folder

```
Select Administrator: Command Prompt - netstat -b
[firefox.exe]
TCP 192.168.35.5:51932 192.168.35.79:5001 SYN_SENT
[owncld.exe]
TCP 192.168.35.5:53861 ec2-54-217-227-128:https CLOSE_WAIT
[Wunderlist.exe]
TCP 192.168.35.5:53862 ec2-54-228-209-122:https CLOSE_WAIT
[Wunderlist.exe]
TCP 192.168.35.5:53866 ec2-54-217-227-128:https CLOSE_WAIT
[Wunderlist.exe]
TCP 192.168.35.5:55073 1hr14s23-in-f42:https CLOSE_WAIT
[googledrivesync.exe]
TCP 192.168.35.5:55484 ec2-23-23-237-251:https CLOSE_WAIT
[mbam.exe]
TCP 192.168.35.5:55485 ec2-23-23-237-251:https CLOSE_WAIT
[mbam.exe]
TCP 192.168.35.5:56769 91.190.218.58:12350 ESTABLISHED
[Skype.exe]
TCP 192.168.35.5:56820 wb-in-f125:5222 ESTABLISHED
[remoting_host.exe]
TCP 192.168.35.5:57025 wb-in-f125:5222 ESTABLISHED
[googledrivesync.exe]
TCP 192.168.35.5:57029 191.232.139.13:https ESTABLISHED
[Skype.exe]
```

Use "netstat" to find out which programs are opening ports.

options it supports, and then giving a summary of each option, such as /q, which lists the owner of the file or folder, in addition to other stats.

Want to know how your folder is broken down into subfolders? Use the **tree** command, and you'll see a tree-like hierarchy of the subfolders inside the current one – pair tree with a specific path, and it shows you the hierarchy for the selected folder.

Want to move to a different directory? Type **cd**, followed by the full path of the folder you wish to visit (enclose paths in double quotes if there's a space in the name), and you'll jump straight there—for example, **cd "c:\program files"**. You can also substitute the path with an environment variable – use **cd %appdata%** to jump to the AppData\Roaming folder inside your personal user folder, for instance. You can also move up and down your folder hierarchy—use **cd <folder>** to enter a subfolder inside the current folder, or type **cd ..** to move up one level.

If you want to switch to a different drive, you'll find the **cd** command has no effect – simply type the drive letter (such as **d:**), and hit Enter, then use the **cd** command to navigate to your desired folder.

COPY, MOVE, DELETE

It's possible to copy, move, rename, and delete files and directories with the Command Prompt, too – use **copy**, **rename**, and **move** for individual files and folders, plus **del** to delete individual files. If you need to delete everything in a folder, use the ***** wildcard—for example, **del *.*** deletes every single file in the current folder. It goes without saying, you should proceed with caution—we suggest sticking with File Explorer when it comes to working with files and folders, unless there's no alternative, or you want to verify files you copy – in which case, use the **verify** on command to do so (and, yes, **verify off** switches this off again).

You can manage folders, too: **md** creates a folder, while **rmdir** removes it. If you plan to delete a folder that isn't empty, use **rmdir /s <directory>** to delete it and its contents. Also, investigate the **robocopy** command, which is designed to copy multiple files and folders in one go – it's very complicated to set up, but is incredibly powerful, too, giving you all kinds of filters and options, such as **/nocomp** (remove all file information from the copied files), and **/b** (backup mode, which allows administrators to copy files they would normally be denied access to). A number of GUI frontends have been developed, but only one is currently available, the

"Robocopy is designed to copy multiple files and folders in one go—it's complicated to set up, but incredibly powerful."

tells it to output the command's results in 'verbose' or detailed mode, rather than as a basic summary. Note that unlike with Linux, flags aren't case-sensitive, so typing **-v** or **-V** results in the same thing.

FIND YOUR WAY AROUND

Let's delve into the Command Prompt proper. First, you'll notice that it opens in one of two locations – if you invoke it as a normal user, it opens inside your personal user folder; if you launch it as an administrator, it defaults to the Windows\System32 directory. You're not stuck in this folder – the Command Prompt has all the tools you need, not just for navigating through your file system, but also moving, copying, and

deleting files, too. We'll start with the **dir** command – type this and it lists all the files and folders in the current folder. Hidden folders don't show up—to make these appear, use **dir /A:H**. The **/A** flag instructs **dir** to show files containing whichever attributes are listed after it – **H** refers to hidden files, while other attributes you can use include **R** (read-only files), **D** (directories), and **S** (system files). Type **dir /A:HD**, and hidden directories are shown instead of hidden files.

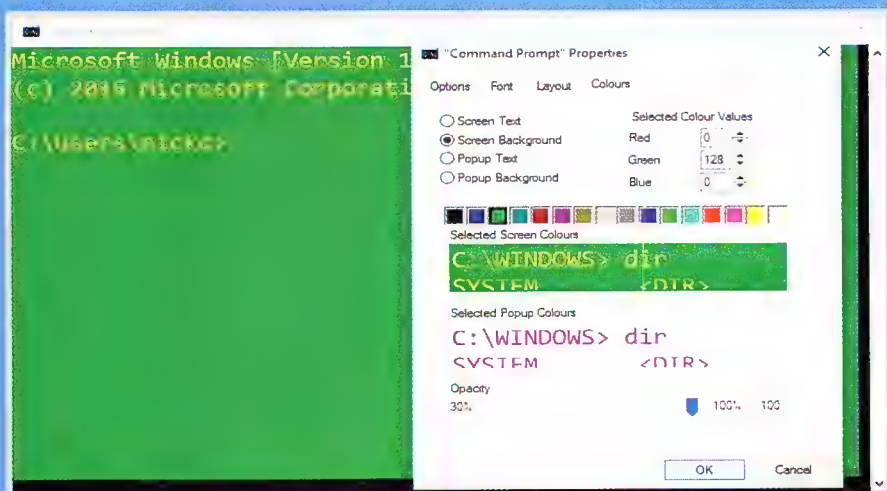
There are lots of other useful flags you can apply to **dir**, too – but how can you find out about them? Simple, either type **dir /?** or **help dir**, and a handy cheatsheet appears, providing a description of the command, what

Customize the Command Prompt

Before delving too deep into the Command Prompt utility, take the time to customize its appearance to your personal comfort. To do this, right-click the Command Prompt icon on its menu bar, and choose Properties. You'll see options spread out over four tabs: Font controls the text type, size, and style, while Colors lets you change the background and text colors, plus make the window semi-transparent (we're not sure why you'd want to, but each to their own).

The Layout tab enables you to set the window size in lines (height) and text characters (width), while the Screen Buffer Size height reveals how many lines you can scroll through. The default size should be sufficient—make sure you leave the 'Wrap text output on resize' option ticked.

The main tab—'Options'—enables you to tweak the command buffer (this is basically your command 'history', and you can cycle through previous commands



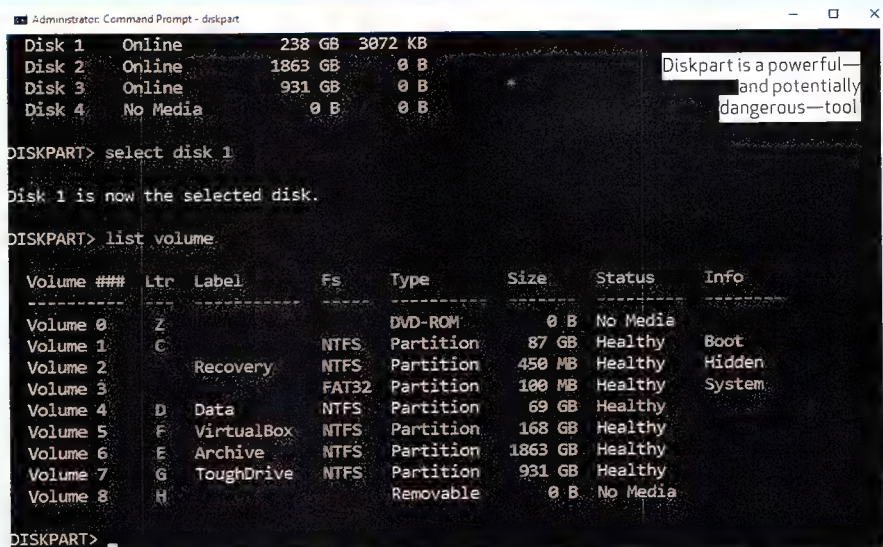
using the up cursor key). You can also change the mouse cursor size, plus enable or disable various features, many of which are new to Windows 10, such as the ability to copy and paste selected text using the keyboard ('Enable Ctrl key shortcuts'). If

you're resolutely old-school, you can tick 'Use legacy console', and do without these feature improvements, but in the majority of cases, we suggest leaving well alone.

commercial GS RichCopy 360 (www.gurusquad.com).

Need to format a drive from the Command Prompt? Use the aptly titled format command. To quickly format the current drive using the same file system, use `format <vol> /Q`, where <vol> is the drive letter (such as d:) of the target drive. Other options include /FS (specify file system, including FAT, FAT32, exFAT and NTFS), /V: (assign a drive label), and /C (compress all files on this volume, this requires NTFS). Like file management, formatting drives is usually best done from within File Explorer itself. Other drive-related commands worth exploring include fsutil, which is a suite of commands offering various tasks for FAT32 and NTFS file systems. Type `fsutil` and you'll see a list of supported commands—use `fsutil <command>` to run one (at which point, you're shown a list of supported options for that subcommand). Keep typing and more options may show—eventually, you'll be able to enter a command such as `fsutil fsinfo volumeinfo c:` to find out useful info about your main system drive, such as its file system, and what features it supports (such as disk quotas and hard links).

If you want to convert a drive from FAT32 to NTFS without losing any of your data, use the convert command. Type `convert <vol> /fs:ntfs`—if the drive is mounted, you may need to add the /x flag to force a dismount, or otherwise reboot if you're converting your Windows system drive. Also consider adding /nosecurity if you want the converted files to be



accessible to all users: `convert d: /fs:ntfs /nosecurity`.

If you want to check a drive for errors, you'll probably remember the `chkdsk` tool from earlier versions of Windows. It's still there in Windows 10—use it on its own to simply scan the current drive, or specify the drive you wish to scan, plus add the /r flag if you wish to both fix problems and attempt to recover readable information from bad sectors—for example, `chkdsk d: /r`. If the drive is in use, you're prompted to schedule the check for the next time you restart Windows.

A related tool is `chkntfs`—by default, Windows runs `chkdsk` at boot time on any drive found to be 'dirty', but you can use this in conjunction with the specified drive and the /x flag to

exclude it from the boot-time check, or /c to schedule it specifically for checking at boot time if it's dirty. A handy flag to remember is /d—this returns things to normal, namely checking all drives flagged as dirty.

GET INFO AND TROUBLESHOOT

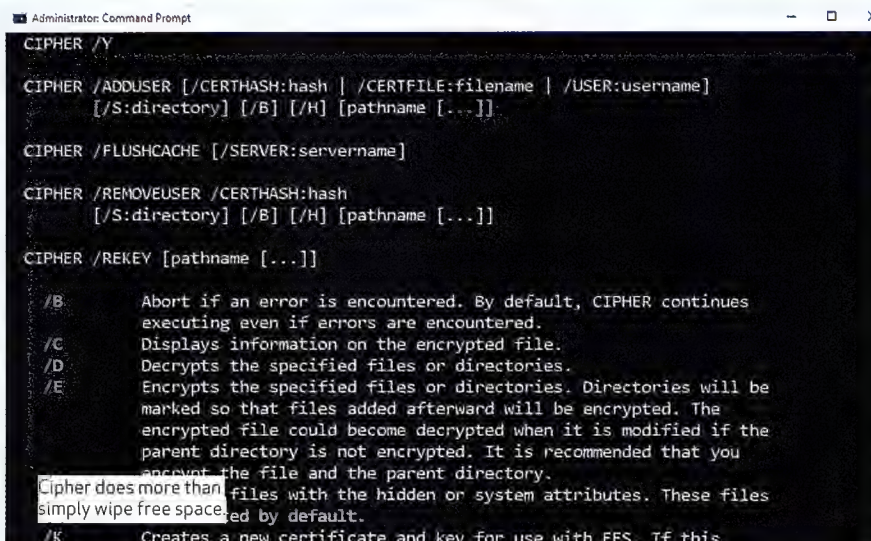
Want a summary of information about your system? Use the `systeminfo` command, which, aside from the usual stuff, can reveal useful snippets, such as when Windows was first installed, and which hotfixes have been added. It can also be used to see whether your PC is capable of Hyper-V virtualization, too.

There are other, more focused information tools, as well. Use `ipconfig` to get information about your local network settings—use the /all flag

for more detailed information. Also, `ipconfig` can be used to fix certain connectivity problems — use `/release` to release the IPv4 address (`/release` works with your network's IPv6 address, if applicable), and `/renew` or `/renew6` to effectively reset it. The `ipconfig /flushdns` may also work when struggling to resolve domain names over the internet. Where more than one network interface is present (often on PCs with virtualization software installed), you can also specify the adapter after your flag: `ipconfig /renew Ethernet`, for example.

Another command that can also prove useful when troubleshooting network and Internet connectivity is `ping`, which can be used to verify connections between local network devices or websites — use it in conjunction with the device name, its local IP address, web address, or remote IP address. If you `ping` using a domain or device name, you're also told its IP address (such as 89.167.142.38 for pcgamer.com, for example).

If the connection works, but is sluggish, use the `tracert` command in place of `ping` — doing so reveals the complete route between you and your target, as well as connection times for each part of the connection, helping you target the middleman causing your problem. Want to know which ports are open on your PC, and where they point? Use the `netstat` command. Try `netstat -b` while running as an administrator if you want to find out more about which program or process has opened



“Device Manager focuses on hardware drivers only, whereas `driverquery` includes software drivers, too.”

which port — it's a slow process, but worth it if you're wondering why a particular port is open.

Need information about drivers on your PC? Device Manager focuses on hardware drivers only, whereas the `driverquery` command includes software drivers, too, such as those installed by your security software and virtualization tool. These are marked as 'File System' drivers, and if you want more information, use the `-v`

flag for detailed data about each driver, including where its files are on your hard drive.

The `-v` flag produces an awful lot of information, so be sure to check the box below to find out how to review this more efficiently, either by scrolling a page at a time, or by outputting it to a text file.

The final tool in this section may already be familiar to you — `powercfg` gives you access to much the same

Command Prompt Tips and Tricks

Windows 10 introduces some handy time-saving features to the Command Prompt, including QuickEdit mode (actually introduced in Windows 8, but let's not split hairs). This enables you to select and copy text from the console quickly, using the mouse—click and drag to select, then right-click to copy it to the clipboard. Place your cursor where you wish to paste it in the console, and right-click again.

Many commands generate pages and pages of data—to save you the onerous task of scrolling back up to review them, add the `/more` option on to the end of offending commands, to force them to show the first page, then pause—from here, press `Enter` to move down a line at a time, or `Space` to scroll through the next page. Alternatively, redirect the information to a text file with the `>switch`—for example, `driverquery -v >drivers.txt` creates the file in your current directory.

Some commands can appear to get stuck

Module Name	Display Name	Driver Type	Link Date
1394ohci	1394 OHCI Compliant Ho	Kernel	30/10/2015 02:36:55
3ware	3ware	Kernel	18/05/2015 23:28:03
ACPI	Microsoft ACPI Driver	Kernel	23/02/2016 06:18:49
acpiex	Microsoft ACPIEx Drive	Kernel	30/10/2015 02:39:16
acpipagr	ACPI Processor Aggrega	Kernel	30/10/2015 02:42:18
AcpiPmi	ACPI Power Meter Drive	Kernel	30/10/2015 02:42:47
acpitime	ACPI Wake Alarm Driver	Kernel	30/10/2015 02:42:21
ADP80XX	ADP80XX	Kernel	09/04/2015 21:49:48
AFD	Ancillary Function Dri	Kernel	05/11/2015 09:28:03
agp440	Intel AGP Bus Filter	Kernel	30/10/2015 02:39:51
ahcache	Application Compatibil	Kernel	30/10/2015 02:09:45
AmdK8	AMD K8 Processor Drive	Kernel	30/10/2015 02:09:49
AmdPPM	AMD Processor Driver	Kernel	30/10/2015 02:09:48
amdsata	amdsata	Kernel	14/05/2015 13:14:52
amdsbs	amdsbs	Kernel	11/12/2012 21:21:44

or keep on looping — break out of them without closing the Command Prompt window by simply pressing `Ctrl-C`. Want to clear the screen buffer and start with a fresh new 'page'? Type `cls` and hit `Enter`. The Command Prompt also keeps a handy history of previous commands — how many

is configured via the Options tab under Command Prompt Properties, which you can cycle through using the up and down cursor keys, speeding up text entry.

information (and options) as you would find in the Power Options Control Panel, but there are some useful options that you can only find here. Start with `powercfg /a`, which provides a useful summary of which sleep states are supported on your PC. One handy management tool is `powercfg /h`, which enables you to both disable and enable the hibernation function — disabling this is worth doing if you don't use it, because you can free up a fair amount of hard drive space (the equivalent of however much RAM is in your PC).

`Powercfg` offers you some useful information, too — use the `/energy` flag to generate a report that highlights energy efficiency and battery life issues that your PC may be suffering from. Once created, a file called `energy-report.html` is saved to the directory you're currently in. Before analyzing it to find out why your PC won't stay asleep, however, try `powercfg /lastwake`, which reveals the last device to wake your computer. Laptop users might want to try `/batteryreport`, which, like `/energy`, saves a report you can view in your web browser. This gives you a full overview of your battery's health, as well as a handy graph showing its usage over the past 72 hours.

AND THERE'S MORE

We've only really scratched the surface of what you can do with the Command Prompt so far — there's still plenty more you can investigate. So, let's start with the powerful — but potentially

"Laptop users might want to try `/batteryreport`, which gives you a full overview of your battery's health."

devastating — diskpart tool. Type `diskpart` and hit Enter, and you're either prompted to open a new window with administrator access, or the cursor changes to 'DISKPART'. Type `help` for a list of supported commands, many of which are potentially destructive — whatever you do, don't proceed further without having a full system image backup in place for all your drives, just in case. Safe commands include `list disk` (list physical drives) and `list partition`, which works on the currently selected drive—switch drives using the `select disk <no>` command. Use `list volume` to view a list of drives by letter. When you've finished with `diskpart`, type `exit` and hit Enter to return to the main Command Prompt.

Want to securely erase some data? The cipher command enables you to wipe the free space in a folder by writing random data to it — delete your files first, then navigate to the folder in question, and type `cipher /w:<path>`, replacing `<path>` with the path to the folder that you wish to clean up. The cipher tool can also be used — as its name implies — to encrypt and decrypt files, too.

You can find out more about specific file types and their associated programs using the `assoc` and `ftype`

commands, and use `bootcfg` to edit the `boot.ini` file (as viewed under the `msconfig` Boot tab). Want to compare the contents of two files? Simply use `fc` to compare your files and list their differences in text. If you want to compare word processing documents, such as those created in Microsoft Word, you need to use the `/l` flag to ensure that only the ASCII text is compared.

Other commands exist that may have value when unable to boot directly into the Windows desktop, but on the whole you're better off using Windows's own graphical-friendly tools. Examples include `at` (schedule commands and programs to run on a specified computer, at a set time and date), `sc` (display and configure Windows Services), `set` (set Windows environmental variables), and both `tasklist` and `taskkill`, which are a pair of commands that enable you to view running processes and terminate them.

There are many more commands to learn and master as well—you can find a complete list at technet.microsoft.com/en-us/library/bb490890.aspx — but here's one final useful command that can come in handy. Need to reboot your PC to the Advanced Start Options menu for a spot of troubleshooting? Just open Command Prompt, type `shutdown /r /o`, and hit Enter. You're welcome!

Working with Batch Files

Batch files are specially created text files that contain a list of Command Prompt commands, which are executed in the order they're written. They can also be used to call executable programs (use the `start` command), and are a great way to make repetitive commands easy to process.

You can create and edit batch files in Notepad — place each command with its options on a separate line. When you come to save the file, set 'Save as type:' to 'All Files (*.*)', before giving the file a `.cmd` extension. There's a number of commands designed for use in batch files. One of the easiest to use is the `pause` command. Place this in your batch file, and when it's reached, the Command Prompt throws up a 'Press any key to continue' message, and waits for a key to be pressed. You can also make use of the `echo` command to display text on-screen, and insert an `@echo off` command at the top of your batch file to prevent the commands themselves from appearing in the Command Prompt window

```
scriptcmd - Notepad
File Edit Format View Help

@echo off
REM This batch file will generate system information files.
REM Make sure it's run as an administrator
echo First, we'll switch directory to your home folder.
pause
cd %homedrive%\%userprofile%
echo Now, we'll generate the files: first, an energy profile and battery
health report.
pause
powercfg /energy
powercfg /battery
echo Next, a general system information report.
pause
systeminfo >sysinfo.txt
echo Now let's look at your network settings.
```

as they're run. Other useful commands include `call`, which enables you to call a second batch file from within the first, plus `choice` and `set` for introducing interactivity through the form of choices for the end user (you can also introduce conditions through the `if` and `goto` commands). Batch files can be run from

within the Command Prompt window (drag them from File Explorer into the window), or simply by double-clicking them in File Explorer—you'll see the Command Prompt window appear, and it disappears when the script completes. Visit technet.microsoft.com/library/bb490869.aspx for a handy reference guide. ■

howto

» QUICK TIPS

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WINDOWS

WHAT ARE THESE REGISTRY ENTRIES?

I was following the information in 'Hack the Windows 10 Registry' from issue 429, but on progressing to the HKEY_CURRENT_USER folder, I stopped as there appears to be some strange entries. Can you help me identify them and whether they're safe to delete, please?

Eddie Rothwell

Eddie sent us an image revealing three Registry keys with Chinese characters, and three further entries with various symbols, indicating another language. These are often mistakenly entered by a program during installation, and deleting them (having taken a System Restore point or other form of Registry backup first) should be the end of the matter – reboot to verify they've gone, as Eddie did, and you can carry on with no further issues. If the entries come back after a reboot, then you'll need to explore the keys and see if there are any Registry values or subkeys that can help you identify where they've come from. If you're still stumped, then it's likely a start-up program is the culprit – focus your search here for a possible offender, or use a tool such as SysTracer (www.blueproject.ro/systracer) to see if you can glean more detail.

Nick Odantzis

HARDWARE

CAN'T COMPLETE DISK CHECK

After three power cuts, my PC can no longer complete the disk check it initiates on startup. Can you help please?

David Lee

The disk check was failing at the same point each time, stating an "unexpected error" occurred at about 50 per cent of the way through stage 2 (verifying indexes) of the process. David could no longer complete a Windows Backup either, with a 'Catastrophic failure 0x8000FFFF' error message. Both problems were linked to the fact there were bad sectors on the drive as a result of the power cuts. We asked David to confirm

Blue Project Software SysTracer v2.10 - Snapshot #1 vs Snapshot #2

Name	Computer	OS	Date	Size	Regs	Files	Apps
Group snapshots by computer							
NICK-PC							
Snapshot #1	NICK-PC	Win 10 Pro x64	2016-02-24 10:47	34.78M	full	full	full
Snapshot #2	NICK-PC	Win 10 Pro x64	2016-02-24 14:51	34.89M	full	full	full

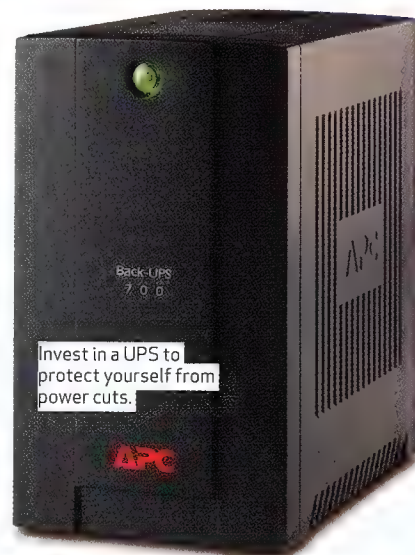
the drive's physical health by installing CrystalDisk Info (<http://bit.ly/crystaldisk>), which it did. Next we instructed David to reboot in Safe mode (see step one of the walkthrough starting at the bottom of the opposite page). Once there, right-click the Start button and choose 'Command Prompt (Admin)' from the Quick Access menu, clicking Yes when prompted. Now type `chkdsk /r/x` and press Enter followed by Y – this instructs the Disk Checking utility to also search for and mark any bad sectors; doing so enables the utility to complete its check successfully the next time you reboot. To best prevent this happening again, we suggest David invests in an uninterruptible power supply (UPS). While it's tempting to pay under \$100 for an entry level model, it pays to spend a bit more for a model like CyberPower's BR650ELCD model. This costs under \$130 and supplies your PC and a monitor with 650VA/390W of battery power, enough to keep your PC running for up to nine minutes during a power cut, allowing you to shut it down safely.

Mayank Sharma

WINDOWS

CRITICAL START MENU ERROR

For no apparent reason, every time I try to open the Start menu or use Cortana,



Windows 10 throws up a 'Critical error' dialogue. I dutifully click the button to log out and log back in, but it has no effect. Is there a way to resolve this error without a repair install?

Dev Price

We managed to trace the source of this particular error to Dropbox – once Dev uninstalled it and rebooted a couple of times, the Start menu started to work


```

Administrator: Windows PowerShell
PS C:\WINDOWS\system32> Get-AppXPackage -AllUsers -Name Microsoft.MicrosoftEdge | Foreach {Add-AppxPackage -DisableDevelopmentMode -Register "$($_.InstallLocation)\AppXManifest.xml" -Verbose}
VERBOSE: Performing the operation "Register package" on target
"C:\Windows\SystemApps\Microsoft.MicrosoftEdge_8wekyb3d8bbwe\AppXManifest.xml".
VERBOSE: Operation completed for:
C:\Windows\SystemApps\Microsoft.MicrosoftEdge_8wekyb3d8bbwe\AppXManifest.xml
PS C:\WINDOWS\system32>

```

Reinstalling Edge in Windows 10 can be done, but requires some command-line tricks.



Epson's Perfection V370 is brilliant with slides and negatives.



Software-compatibility issues with specific CPU brands are generally a non-issue with today's processors.

properly again. In fact, Dev was even able to reinstall Dropbox without the error returning; however, other users have subsequently reported the error returning after a short delay. Although it's tempting to put the blame squarely on Dropbox's shoulders, as this isn't the first time a third-party app has appeared to break the Start menu in this way – it's also been linked to some security programs including Avast!, for example. The actual issue is more likely to be an underlying weakness with the Windows Shell that allows programs to make changes that subsequently break part of it on certain set-ups – we can but hope Microsoft is working on a fix.

Graham Barlow

WINDOWS REINSTALLING MICROSOFT EDGE

For no apparent reason Microsoft Edge has vanished from my Windows 10 PC. How can I get it back?

Alan Orrell

The simplest, but most time-consuming, fix is to perform an in-place upgrade of Windows 10 using the Media Creation Tool – the

equivalent of a repair install. This fixed Alan's problem, although it took six hours. Alternatively, try to delete and reinstall Edge as follows:

1. Reboot in Safe mode by opening 'Settings > Update & Security > Recovery' and click 'Restart now' under 'Advanced startup'. Select 'Troubleshoot > Advanced options > Start-up Settings > Restart' and press 5 to enable Safe mode with Networking.
2. Once logged into Safe mode, press Windows-R to open the Run dialogue box, type %localappdata%\Packages and click 'OK'. Locate the Microsoft.MicrosoftEdge folder in the list, then right-click it and choose 'Delete'. Reboot into Windows.
3. Type powershell into the Search box, then right-click it and choose 'Run as administrator'. Type


```
Get-AppXPackage -AllUsers -Name Microsoft.MicrosoftEdge | Foreach {Add-AppxPackage -DisableDevelopmentMode -Register "$($_.InstallLocation)\AppXManifest.xml" -Verbose}
```

 and press Enter. When 'Operation

completed' appears, Edge should hopefully be back.

Cat Ellis

IMAGING WHAT IS THE BEST NEGATIVE SCANNER?

I am looking to create digital copies from a lot of negatives and slides taken 50 or so years ago. Is there a good value-for-money scanner available to do this job. If so, what would you recommend?

David J Rosser

Epson's Perfection V370 scanner has been around a number of years, but is particularly renowned for its quality when scanning negatives and slides – including those made from glass. It comes with a specialist slide holder that can hold four slides at once, and is also capable of scanning in large bulky objects such as books without adversely affecting the quality of the image thanks to its CCD image sensor, which has a greater depth of field than cheaper CIS-based scanners. It's also perfect for general A4 scanning too. Expect to pay around \$200 online.

Nick Odantzis

HARDWARE CHEAP CHIPS AND COMPATIBILITY

A long time ago, there were programs that didn't work correctly on AMD processors. Is this the case in today's world? I only tried AMD one time and ran into issues. But I am tired of paying through the nose for Intel processors. I'm wondering because AMD's CPUs are less expensive.

Michael Flyaw

Intel and AMD host processors share a common instruction set, so you should see no difference in application support between them. The issues you refer to might have been related to platform drivers. We do remember various times when third-party chipsets from AMD, Nvidia, SiS, and VIA caused headaches. But Intel wasn't immune to problematic hardware either.

The short of it is this: modern CPUs from both manufacturers enjoy broad compatibility. And you're right in that AMD's portfolio is predominantly less expensive. However, the FX CPUs and A-series APUs don't do as much work per clock cycle as their Intel counterparts. In other words, at any given frequency and core count, expect them to be slower. Enthusiasts looking to get the most from an AMD processor should pick a model with more cores than Intel's equivalent at the same price. There's a good chance you'll see better performance in threaded apps and heavy multitasking.

APC team ■

Solve Windows 10 install problems

Luis Villazon talks blank monitors, dodgy drivers and missing RAM.

A FRESH START

I've been using Windows 8.1 since it came out, and I've suspected — but never been able to prove — that I had some viruses or other stuff installed. Nothing I've tried has got rid of it, including reinstalling. I'm wondering if installing Windows 10 might help. Will upgrading clear everything out, including viruses?

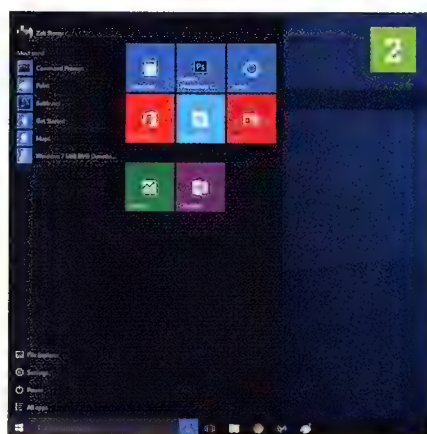
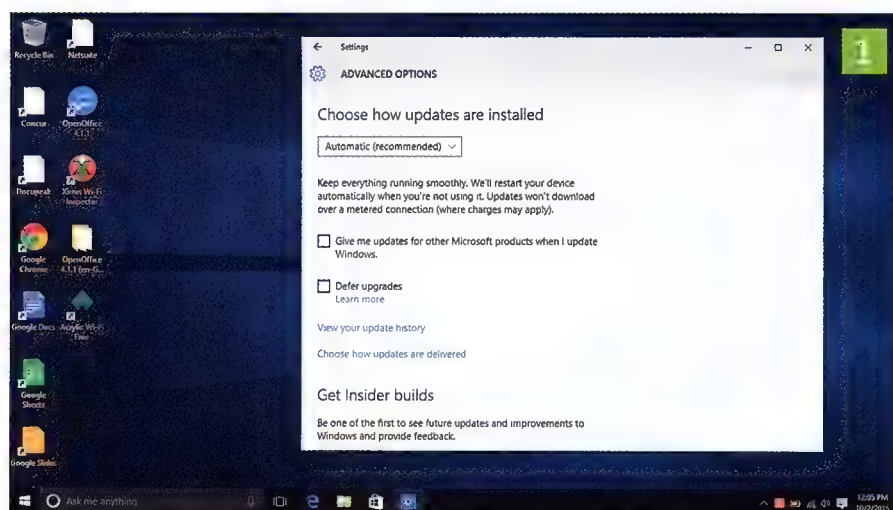
You shouldn't assume it's a virus every time your PC runs slowly, crashes, or doesn't do what you want. If you think you have a virus, boot into Safe Mode and run a free online scanner, such as the one at <http://housecall.trendmicro.com>. If that comes up clean, you don't have a virus.

If you did have a virus under Win 8.1, upgrading to Win 10 won't get rid of it. The upgrade process leaves your documents and applications as is, and nearly all Win 8 executables also run under Win 10, so any infected files on your old system would run the virus code on the new system as well.

PLUNGED INTO DARKNESS

I upgraded to Windows 10 from Win 7, and the screen went black after the first reboot. It came back during another reboot in the upgrade process, but then it went black again — and stayed that way. Stupidly, I didn't back up before I began the update, so I can't roll back. I've tried swapping the monitor and it makes no difference. I've tried hitting F8 to get Safe Mode, but that doesn't work either. What are my options?

This is partly Microsoft's fault for not testing Windows 10 on the particular graphics card and driver combo you are using. But, it goes without saying, that it's really important to back up. If you had a valid backup, you could then roll back to Windows 7, enable Remote Desktop Protocol (RDP), run the Win 10 upgrade again, and then use RDP to connect to your blank-screen PC from another one, and fix your graphics driver problem. You can't boot into Safe Mode from Windows, because you can't see what you're doing, and most modern PCs with UEFI BIOSes and SSDs boot much too



quickly to detect the F8 keypress. This means you'll have to temporarily install an alternative cheap graphics card just to give you some eyes on the ground. Then you can go to Nvidia or AMD, and download updated drivers that work with Windows 10.

ARE UPDATES BAD?

I upgraded to Windows 10 on release day and, so far, it runs like a dream. But I'm concerned about automatic updates. People have been telling me it can't be turned off, and some of my friends aren't upgrading because they say this could be a security risk if one of the updates has a bug or something. If it is a risk, is there a way of disabling the updates?

Automatic updates are compulsory in the Home edition of Windows 10

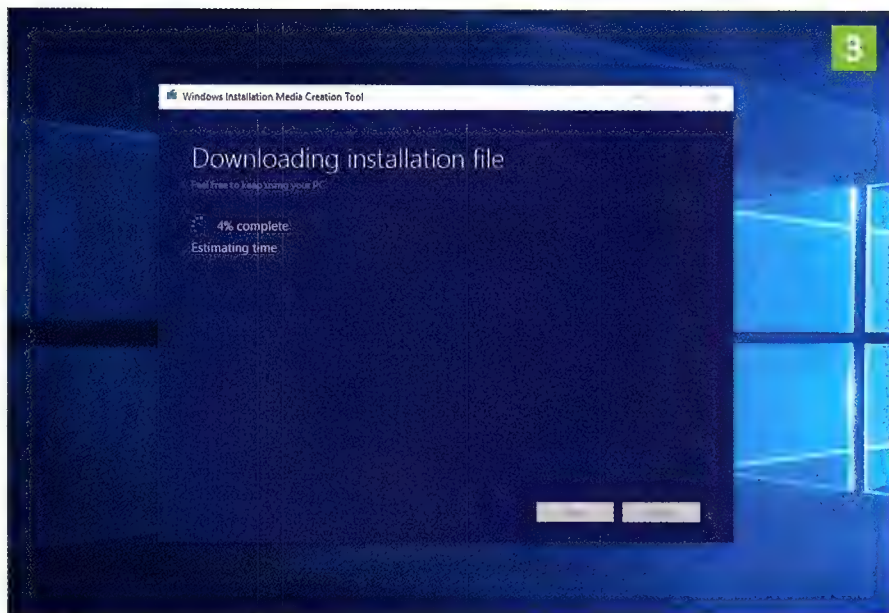
[Image 1]. If you have Windows 10 Pro, you can defer your updates for a few months, to give your IT department time to test it with your existing drivers.

While it is theoretically possible for a bug to get in, it's a much lower risk than that of leaving automatic updates off. Security updates are released to patch known vulnerabilities. By definition, every day that you don't patch this hole is a day that you are vulnerable. No Windows update has ever been released with malware in it, and the version of Windows with the least consistent update record (XP) is also the version most infected by malware. Forcing automatic updates will make Windows 10 the least infected version, and is the most important security advance since Microsoft started making updates available online at all.

MORE LIKE THE "STOP MENU"

Is there a way to add any program to the Start menu in Windows 10? When I drag a file on to it, nothing happens. I heard that creating a shortcut in C:\ProgramData\Microsoft\Windows\Start Menu\Programs would do it, but this just gives an error message.

It sounds as though you're not logged in as administrator — C:\ProgramData is for the system Start menu [Image 2], which is global for all user accounts, and you need to be administrator to write there. Even if



"I upgraded to Windows 10 from Win 7, and the screen went black after the first reboot. It came back during another reboot in the upgrade process, but then it went black again — and stayed that way"

you are administrator, some apps don't like launching from there. Try "%appdata%\Microsoft\Windows\Start Menu\Programs" instead. If you open a command prompt window, you can type "CD," followed by this path name, and hit Enter to navigate there. Or else you can use Windows Explorer to open C:\Users\your username\AppData\Roaming, which is what the "%appdata%" normally expands to.

But, really, this is just tinkering around the edges. What you need to do is give yourself administrator access on your account. If it's your PC, you should normally be logged in as administrator if you ever want to get anything done.

Non-admin accounts are for young children and guests. If the PC isn't yours, ask your parent/spouse/room-mate to give you a proper login. Or you could always get your own PC and lock them out of it, if you prefer to escalate things.

WHEN IS SIX LESS THAN TWO?

I would like to take advantage of my free upgrade to Windows 10. I registered for the upgrade, but on the release day, I was told I don't have enough RAM on my PC. The trouble is, I do! I have 6GB currently installed, and Windows says it needs at least 2GB. What can I do? Would adding more RAM help?

We've seen this situation a couple of times. The Get Windows 10 app isn't perfect, and sometimes it misidentifies the amount of RAM that is installed on your PC. This might be because of an odd RAM configuration, or maybe you have some software running that is somehow masking how much the rest of Windows can see. It's also possible, of course, that one of your RAM modules is faulty, and you do, in fact, only have 2GB of physical RAM. But assuming you can reboot with just the 4GB module, this might shake things up enough to let you upgrade.

Get Windows 10 isn't a first-come-first-served queue, though. It also takes into account compatibility. So, if your PC is old or unusual, and you also hobble it by leaving it with only just enough RAM, you might find that you don't get an invitation to upgrade for a few weeks more. If you can't be bothered to wait, just run the installer directly from www.microsoft.com/en-us/software-download/windows10ISO [Image 3].

WE'LL SCREAM FOR WIDESCREEN

I was wondering who chooses which resolutions make it to the standard list of screen sizes that Windows and monitors accept? Why is it 1280x1024, for instance, and not 1200x1000, or

1500x1100? And why is 1366x768 still common in Windows 10 laptops? It's not a multiple of anything in either direction, and 683:384 is hardly a standard aspect ratio!

1366x768 is actually 16.008:9, which is actually only off from the standard 16:9 widescreen resolution by less than 0.05 percent. In other words, it's the closest even-numbered horizontal resolution that converts a 1024x768 resolution into widescreen.

Why 768 vertical pixels, you ask? In the beginning, there was CGA resolution, which was 320x200. This was horrible, and didn't fit properly on 4:3 aspect ratio TVs, so they doubled it horizontally, and slightly-more-than-doubled it vertically to produce VGA, which was less horrible. If you double that in both directions again, you'd get 1280x960, but this requires more than 1Mb of screen buffer. By the time graphics cards became good enough to do that, we were watching TV on widescreen. It's much easier to downscale 1080p HD to 1366x768, because they are both 16:9 aspect ratios. And if you need 4:3 resolution, you can stick some black bars on the side and call it 1024x768.

The odd one out here is 1280x1024 — not 1366x768 — because 1280x1024 is the only 5:4 aspect ratio screen resolution, which means it doesn't display well on just about any modern screen. The only reason it probably lasted so long is that 1,024 is a round number in binary, and is therefore easy for chip designers to address.

MIND CONTROL

I'm new to Windows 10, and was wondering where Control Panel went.

It's gone to the same place Control Panel always goes every time there is a new version of Windows: into the realms of confusion, hidden behind new and mysterious aliases and analogs. Control Panel has the least consistent interface design of any part of Windows, and that's still true in Windows 10. In fairness, Win 10 has slightly improved the situation over Win 8, but it has achieved this with a new layer that stands between us and the Control Panel we actually need.

The new layer is Settings, which you can reach from the Start menu directly. It has a pared-down interface, with icons for the most common options, which are easy to tap on a touch screen. You can still open the old Control Panel by searching for it on the Start menu. But note that there's no direct correspondence between Settings and Control Panel — neither is a direct subset of the other. ■

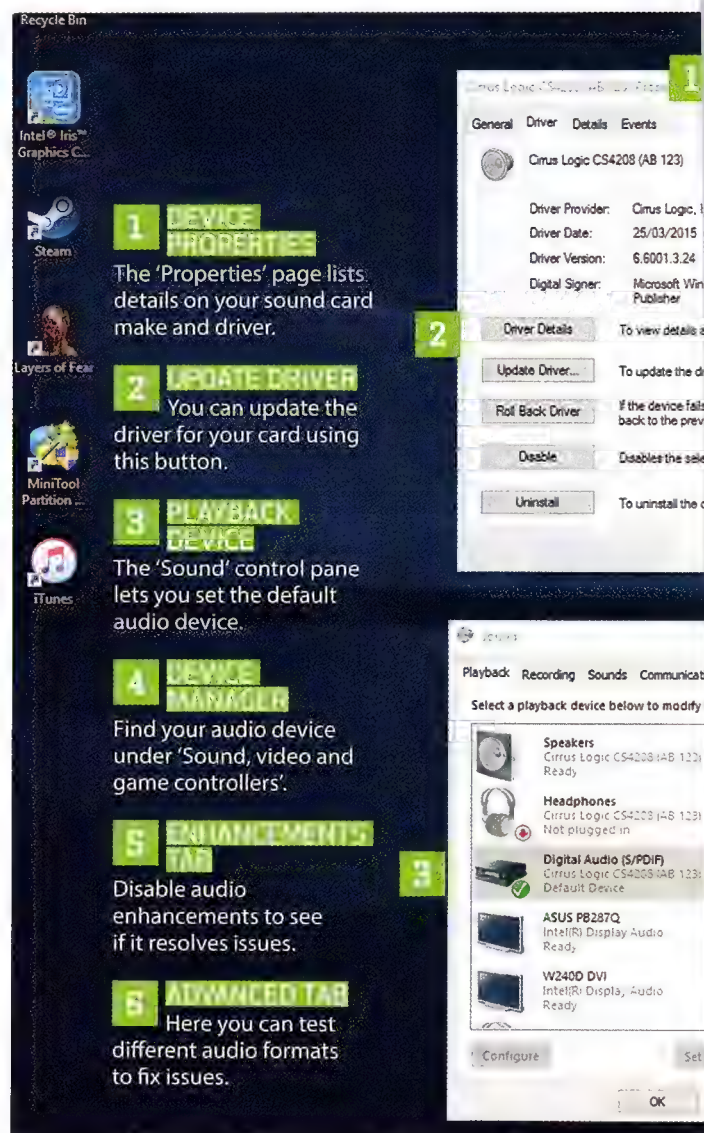
Fix audio issues in Windows 10

Tim Hardwick reveals how to track down the source of your sound issues in Windows 10 — simply follow these steps.

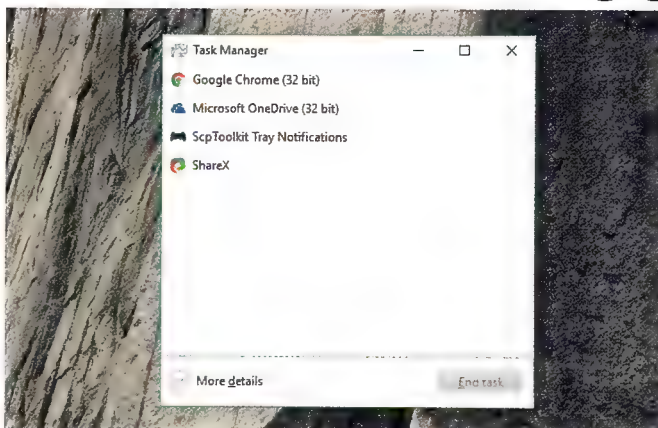
For all the benefits that come with upgrading to Windows 10, there have been reports that some people have experienced problems with sound output, leaving them unable to enjoy movies or hear anything at all from their PC's speakers.

For example, users whose PCs have VIA HD Audio have found they can only hear sound from certain apps. Fortunately, there's a workaround if you're affected by this issue. Right-click 'Playback Devices', right-click the audio output device and set it as the default device. Then select the device with your left mouse button, choose 'Properties', select the 'Enhancements' tab and check 'Disable all enhancements'. That should fix the problem.

For everyone else with audio issues, try the following steps. You'd be surprised at how effective they can be.

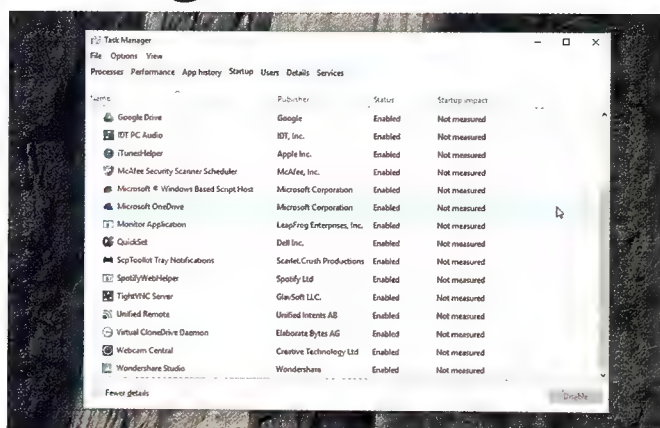


Get audio sounding great again in Windows



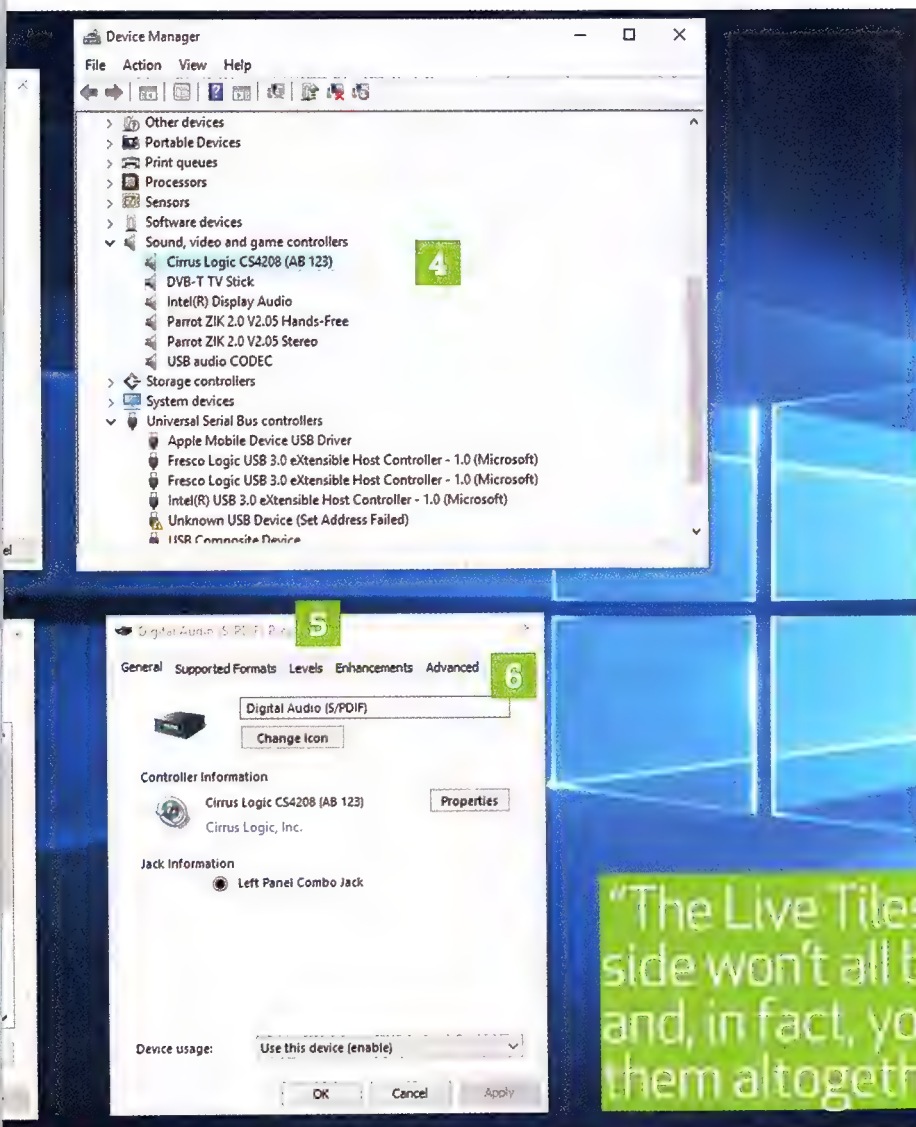
1 START ATTACK

If you've upgraded or picked up a new PC with Windows 10 preinstalled, it's likely that a number of existing programs will run at startup. Each one of these takes time to load, contributing to that laboured power on sequence. Hit Ctrl-Shift-Esc to open Task Manager, click the arrow to see more information, then click the Startup tab to see the offenders.



2 CHOOSE YOUR VICTIMS

You'll see a whole list of programs, the majority of which you've probably never used. So with the exception of your anti-virus software, you're safe to disable as many as you like. Reboot your machine, and you should notice the difference. If you disable something, then find you need it, head back to Task Manager to switch it back on again.



Tim's best tip!

As with most issues, don't underestimate the power of a simple restart. That's often all it takes to resolve a problem.

Jargon buster!

Device Manager

A native Windows utility that displays information about the driver profile for all the hardware present on your system.

Audio driver

A piece of software specifically coded for your audio hardware that enables Windows to integrate it into the system.

Sound card

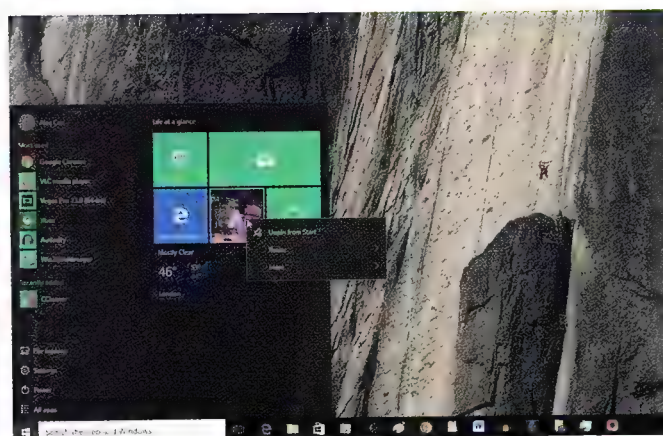
A removable PCB that fits in a socket on your PC's motherboard if the latter doesn't have an onboard audio chip.

"The Live Tiles on the right-hand side won't all be to your taste and, in fact, you can get rid of them altogether"



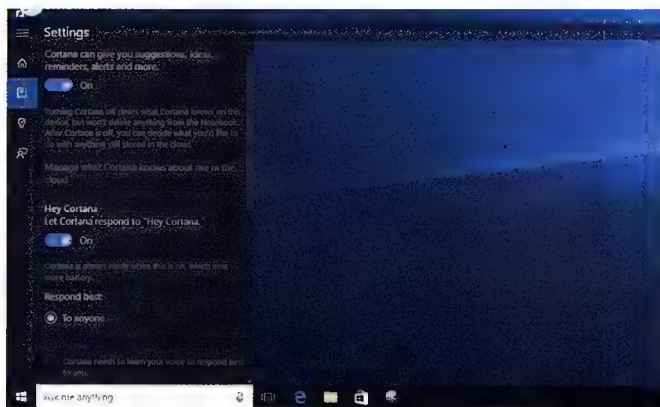
3 QUICK UNINSTALLATION

While we're dealing with software, let's clean away some unloved applications. Windows 10 makes this easier than ever. Any application you've installed can be removed by finding it in the Start menu's 'All Apps' list, right clicking, then selecting 'Uninstall'. Sadly, this won't work for Microsoft's preinstalled applications, however infrequently you might use them.



4 MENU MASSACRE

Let's look at the Start menu more closely, as it's ripe for a little streamlining. The Live Tiles on the right-hand side won't all be to your taste and, in fact, you can get rid of them altogether, although it's going to take a little time. Right-click each one, and select 'Unpin from start' until they're all gone. This will reduce your Start Menu to a single column.

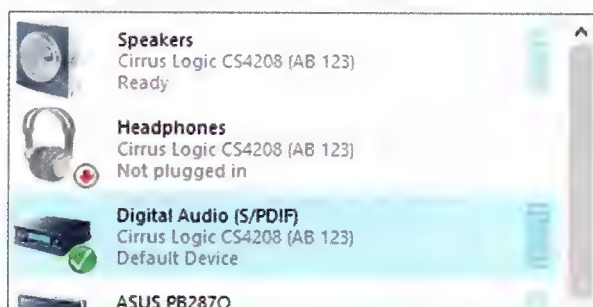


1 CORTANA WON'T LISTEN

When enabled, Microsoft voice assistant Cortana is meant to listen to your commands upon hearing the words 'Hey, Cortana'. If it isn't hearing you, make sure your PC's microphone is on. Also, check the settings — open Cortana, select the Notebook icon and then Settings; make sure the option for Cortana to listen for 'Hey, Cortana' is turned on.

Playback Recording Sounds Communications

Select a playback device below to modify its settings:



2 SET DEFAULT DEVICE

If you're connecting to an audio device using USB or HDMI, you might need to set that device as the default before you hear anything. To do so, open the Start menu, type Sound into the search box and select it from the list of Settings results. Next, click the Playback tab, select the device you're trying to connect, and click 'Set Default'. If this doesn't work, connect the device to another port.

General Supported Formats Levels Enhancements Advanced

Default Format

Select the sample rate and bit depth to be used when running in shared mode.

2 channel, 16 bit, 44100 Hz (CD Quality)

Test

Exclusive Mode

- ☒ Allow applications to take exclusive control of this device
- ☒ Give exclusive mode applications priority

3 CHANGE AUDIO FORMAT

Sometimes, incompatible drivers or third-party audio software can affect playback, so check if an audio format is the source of your issue. In the 'Sound Control' panel, select Playback, right-click the 'Default Device' and choose Properties. Select 'Advanced' and under 'Default Format', change the setting, then retest your audio. If that doesn't work, try another format.



4 CHECK CABLES

Check your speaker and headphone ports for loose cables, the wrong jack and flex wires to see if there's a poor connection. Also, check your power and try turning the volume controls up. Some speakers and apps have their own volume controls, so you might have to check them all. Remember, your speakers are probably set to go off when your headphones are plugged in.

General Supported Formats Levels Enhancements Advanced

Select the enhancements to apply for your current speaker configuration. Changes may not take effect until the next time you start playback.

☒ Disable all enhancements

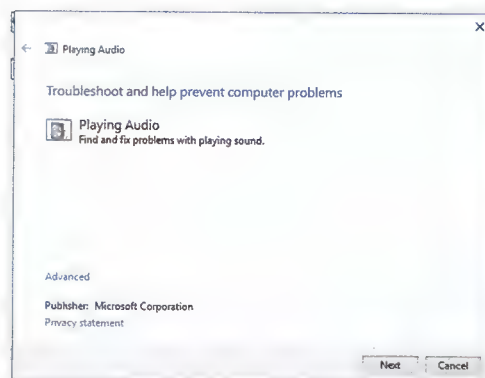
- ☐ Low Frequency Protection
- ☐ Virtual Surround
- ☐ Room Correction
- ☐ Loudness Equalization

Enhancement Properties

Description:

5 BAD ENHANCEMENTS

Sometimes the issue can lie with the audio enhancements that Microsoft or third parties have designed. Happily, you can turn them off. Open Start, type Sound into the search and select 'Sound Control Panel' from the list of Settings results. Select the Playback tab, right-click the 'Default Device' and choose 'Properties'. On the Enhancements tab, check 'Disable all enhancements'.



6 TROUBLESHOOTER

If all other efforts fail to solve the problem, try Windows 10's native audio troubleshooter. Occasionally, it can resolve an issue you're having. To run it, open Start, type troubleshooting into the search box and select it from the Settings results. Then, under 'Hardware and Sound', click 'Troubleshoot audio playback' and click Next in the window that appears. ■

VBA macros: make one spinner do the work of many

Helen Bradley shows how to make an Excel spin button do the work of many multiple spin buttons.

Spin button controls let your user click a button to change a value. They are typically used in user forms but, because they are also part of the ActiveX Controls collections you can also place them on a worksheet. When you have multiple cells you want to manage with spin buttons the worksheet can become crowded and hard to manage. The simpler solution is to make a single spin button do all the work. We'll show you how.

Typically a spin button on a worksheet is linked to a cell and it has some limits in terms of the values it can provide. If you bypass these settings and simply use the spin button events to trap the user interaction then you can make it do whatever you want it to do.

THE MORTGAGE CALCULATOR

To see this at work, we will create a simple mortgage payment calculator. The initial values and labels are type in cells B3:C5 and cell B7. Type this formula in cell C7 to make the mortgage payment calculation:

$$=PMT(C4/12,C5*12,C3)*-1$$

We'll use a spin button to change values in the cells C3, C4 & C5. To add this, click the Developer tab, click 'Design Mode', and from the Insert list click the 'Spin Button (ActiveX control)'

and drag a spin button onto the worksheet. Right click the control and choose 'View Code' to open the code dialog. Add this code to the code dialog:

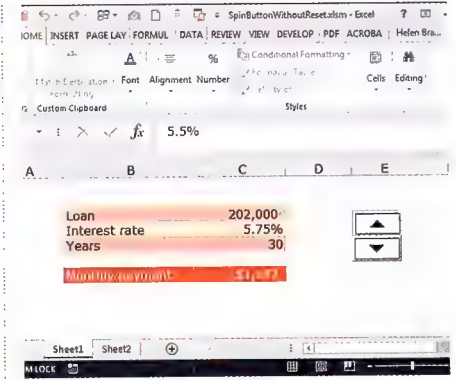
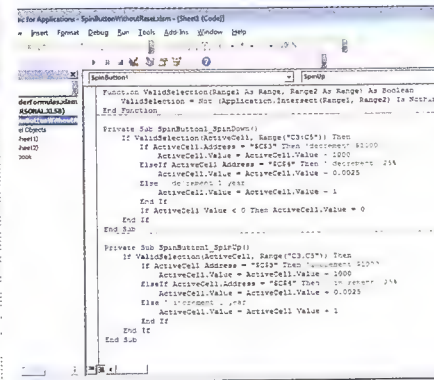
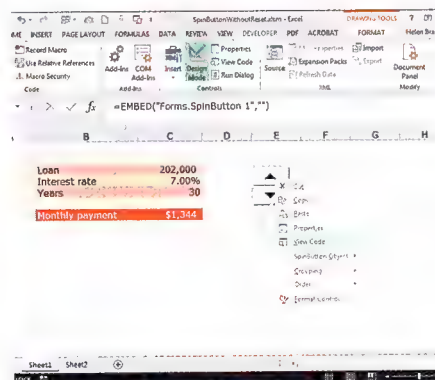
```
Function ValidSelection (Range1 As Range, Range2 As Range) As Boolean
    ValidSelection = Not (Application.Intersect(Range1, Range2) Is Nothing)
End Function

Private Sub SpinButton1_SpinDown()
    If ValidSelection(ActiveCell, Range("C3:C5")) Then
        If ActiveCell.Address = "$C$3" Then 'decrement $1000
            ActiveCell.Value = ActiveCell.Value - 1000
        ElseIf ActiveCell.Address = "$C$4" Then 'decrement .25%
            ActiveCell.Value = ActiveCell.Value - 0.0025
        Else 'decrement 1 year
            ActiveCell.Value = ActiveCell.Value - 1
        End If
        If ActiveCell.Value < 0 Then ActiveCell.Value = 0
    End If
End Sub

Private Sub SpinButton1_SpinUp()
    If ValidSelection(ActiveCell, Range("C3:C5")) Then
        If ActiveCell.Address = "$C$3" Then 'increment $1000
            ActiveCell.Value = ActiveCell.Value + 1000
        ElseIf ActiveCell.Address = "$C$4" Then 'increment .25%
            ActiveCell.Value = ActiveCell.Value + 0.0025
        Else 'increment 1 year
            ActiveCell.Value = ActiveCell.Value + 1
        End If
    End If
End Sub
```

```
Private Sub SpinButton1_SpinUp()
    If ValidSelection(ActiveCell, Range("C3:C5")) Then
        If ActiveCell.Address = "$C$3" Then 'increment $1000
            ActiveCell.Value = ActiveCell.Value + 1000
        ElseIf ActiveCell.Address = "$C$4" Then 'increment .25%
            ActiveCell.Value = ActiveCell.Value + 0.0025
        Else 'increment 1 year
            ActiveCell.Value = ActiveCell.Value + 1
        End If
    End If
End Sub
```

Disable Design Mode, save the worksheet as a macro enabled worksheet and test the spin button. When the active cell is outside the range C3:C5 nothing happens when you click the spin button. If either cell C3, C4 or C5 is active then depending on whether the up or down arrow is selected, the value in that cell is incremented or decremented by 1000 for the loan amount, 0.25% for the interest rate and 1 for the term of the loan. If any value falls below zero it is reset to 0.



1 STEP 1
This code controls the spin button behaviour.

2 STEP 2
Right-click the spin button and select 'View Code' to open the code dialog.

3 STEP 3
To test the solution, click in cell C3, C4 or C5 and click the spin button. ■



Build an AirPrint server

Add AirPrint support to any USB or network printer in your home.

Anyone who's needed to print a document from their iPad or iPhone will know the value of AirPrint. Apple introduced it back in 2010, and it's steadily grown in popularity – over a thousand printers now ship with built-in AirPrint support (see bit.ly/mfairprint for a list). But don't despair if your trusty printer isn't supported – you can hook it up to an AirPrint-enabled print server. You could splash out up to \$99 on something like StarTech's Wireless-N USB AirPrint Server, but why spend all that money when there's a satisfying do-it-yourself project awaiting, and a couple of bucks to be saved?

WHAT YOU'LL NEED

This project uses the flexible Raspberry Pi Zero. You'll need four products, which will cost around \$60 before postage: the Pi Zero with adaptors; a Broadcom USB Hub and

Wi-Fi adaptor; an official power adaptor; and a 8GB NOOBS card. The Pi Zero is often out of stock, so sign up for email notifications to secure one when it's next available, if necessary.

You can save money by reusing an existing MicroSD card, which must be 8GB or larger, and you'll also need an SD card adaptor or USB MicroSD card reader depending on whether or not your Mac has an SD card slot. Follow the instructions at bit.ly/startnoobs to download NOOBS on to it.

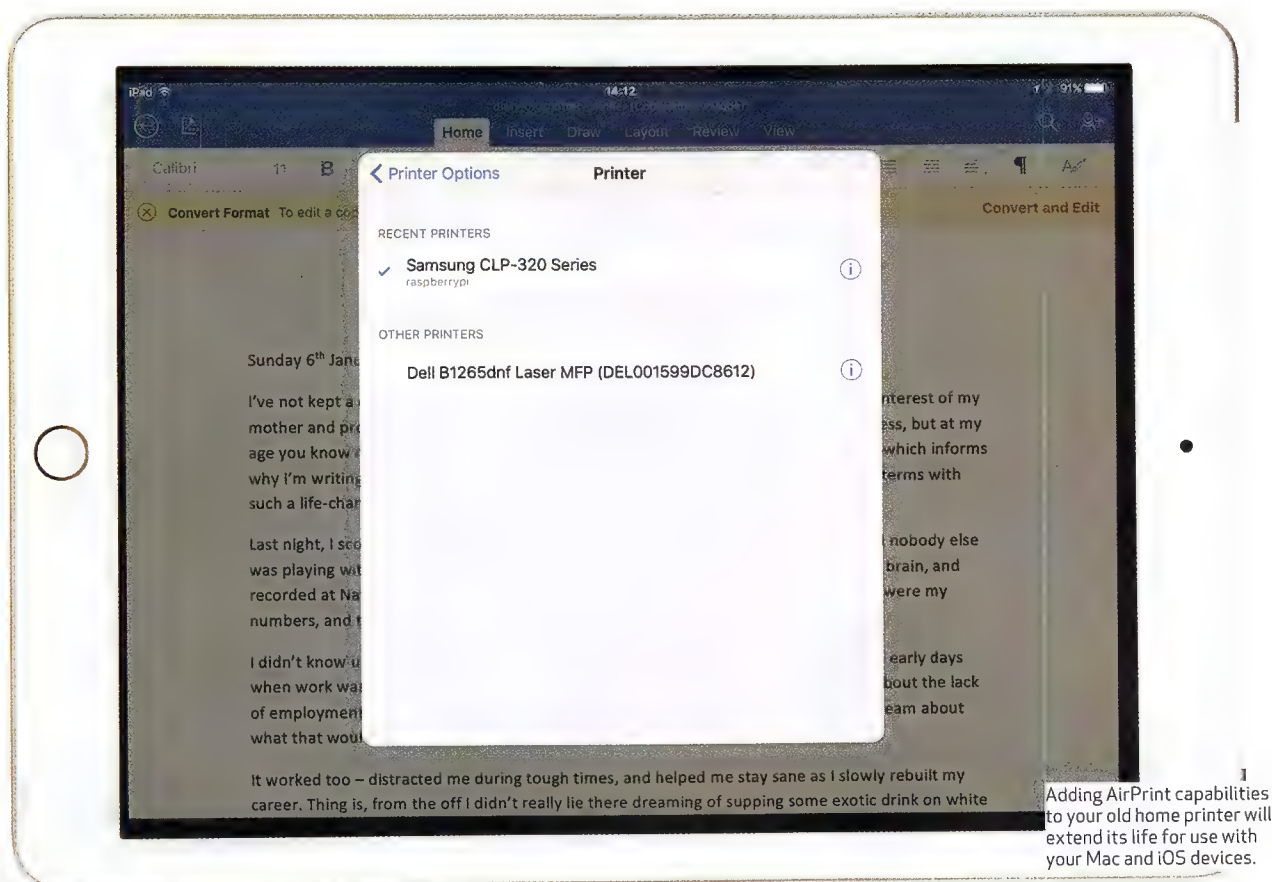
You'll need access to a monitor with an HDMI input, and a USB keyboard and mouse to install and configure Raspbian. The big issue is that the USB hub only has two ports – this isn't a problem if your printer connects directly to the network (wirelessly or

using Ethernet), but if it's a USB model you'll need to combine the mouse and keyboard on a single port. Apple's wired keyboards have two built-in USB ports, allowing you to connect the mouse through that. Or, consider buying a budget wireless keyboard and mouse set. Just make sure they share a single USB receiver.

BASIC INSTALLATION

Start by inserting the NOOBS card into your Pi Zero, then connect the Broadcom adaptor to the Pi using the USB converter cable. Connect the keyboard to one USB port on the adaptor, plug the mouse into the other port, and your USB printer on the other port. Switch on the printer and monitor, then plug in the power –

You can add AirPrint to your USB printer using a Raspberry Pi



there's no switch so, if all is well, the Pi should start up immediately.

You'll see a screen with just one entry: Raspbian. Select that, then click the Install button followed by Yes, and wait for the files to be copied. This is a lengthy process, so be patient – while you wait, verify the language and keyboard settings are correct at the bottom of the screen. Once complete, click OK to restart the Pi Zero in Raspbian.

You'll see a series of scrolling messages, and after about a minute the screen will go blank – again, be patient, and the Raspbian desktop should eventually appear (future startups are

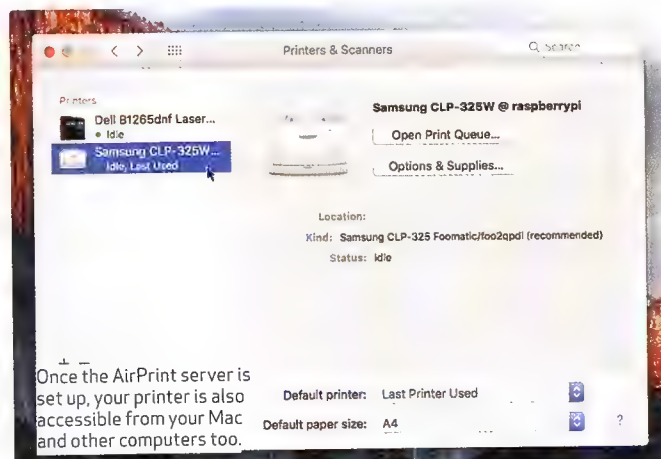
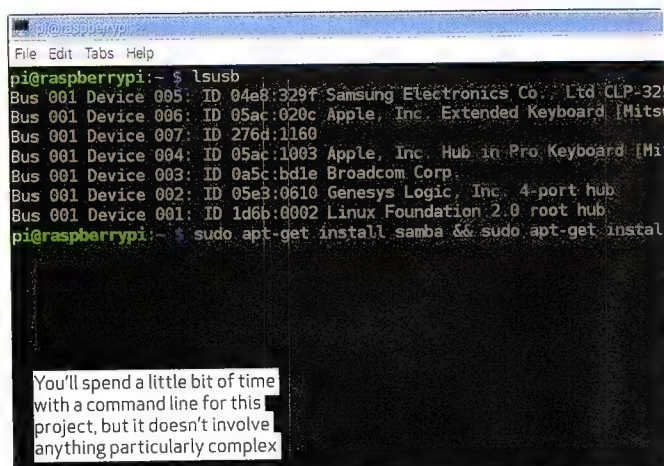
much quicker). Test both the keyboard and mouse are working, then click the network icon in the top-right corner to connect to your local Wi-Fi network.

Next, it's time to get your hands dirty using Raspbian's Terminal. Click the shortcut to it (the black monitor) in the menu bar. First, if your printer is connected using USB, enter `lsusb`. (Skip this if you're planning to connect to a network printer.) This lists all the USB-connected devices on your Pi, among which you should see your printer's manufacturer, confirming it's connected.

Enter `sudo apt-get update && sudo apt-get upgrade` to ensure

installed packages are up to date, then the following command to install the Samba sharing components and the CUPS printing system: `sudo apt-get install samba && sudo apt-get install cups`. Follow any prompts and, after both packages have been installed, enter this command, which lets you set up and manage your printer: `sudo usermod -a -G lpadmin pi`.

Printer setup is the trickiest part of the process, depending on whether it's supported and what drivers are available for it, but at least CUPS is configured through your web browser, providing you with a more user-



What you'll need

1 PI ZERO

We've chosen the Pi Zero due to its low cost and incredibly small size

2 ACCESSORIES

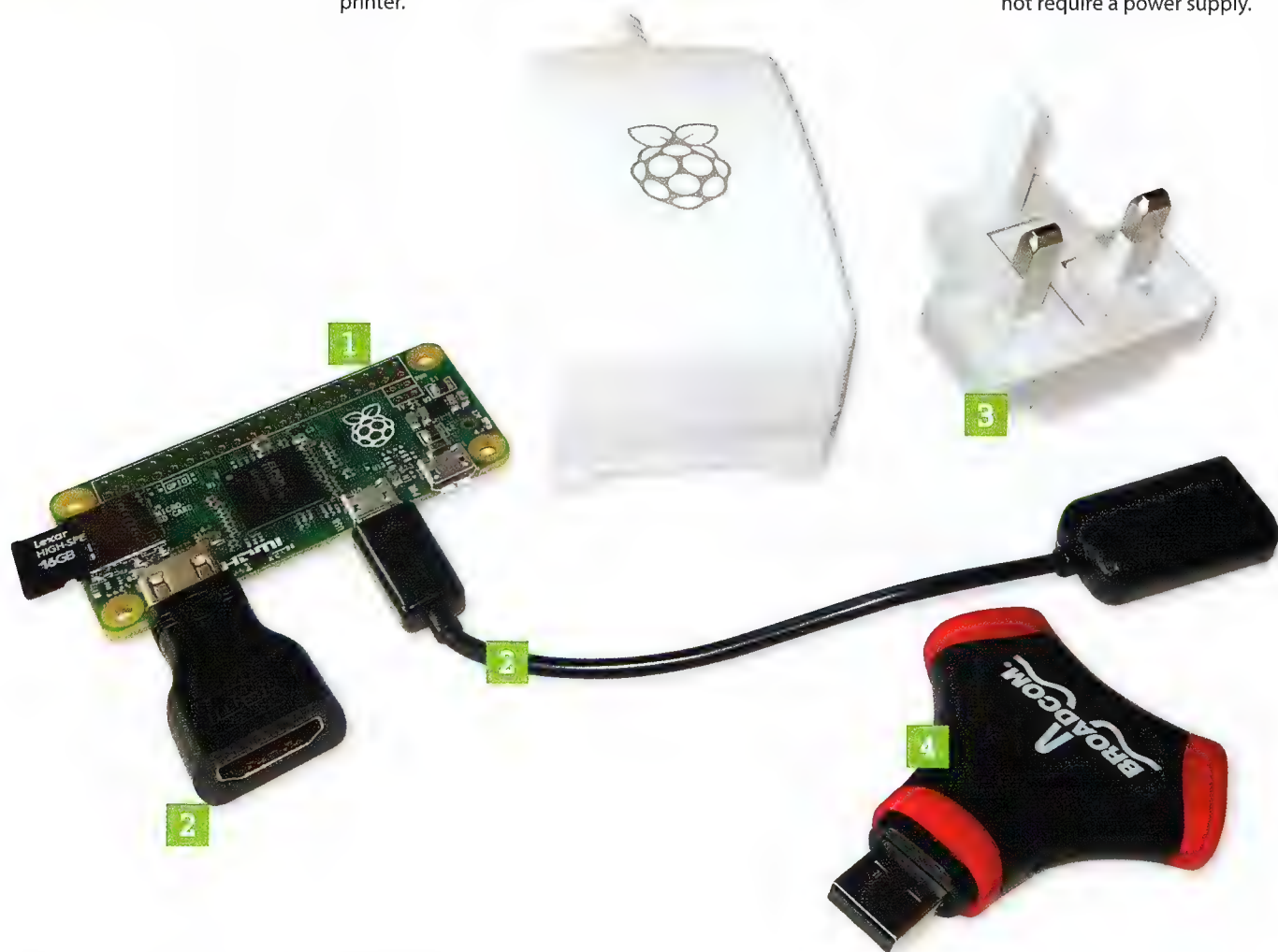
You'll need a MicroSD card, plus adaptors to connect your monitor, a keyboard and a printer.

3 POWER ADAPTOR

The official Raspberry Pi adaptor is a great choice for supplying power to the Pi Zero.

4 USB HUB

This Broadcom hub includes two USB ports and a built-in Wi-Fi adapter. It does not require a power supply.



friendly interface. The walkthrough opposite will help you with this part of the process.

Once you've successfully printed a test page, there's just one last tweak: switch to CUPS' Administration tab, turn on 'Share printers connected to this system' (and 'Allow printing from the internet' if required), then click 'Change Settings'. Your printer will now be set up, shared and ready for the final stage.

SET UP AIRPRINT

The Pi's Wi-Fi adaptor has power management switched on, which can cause problems, so let's disable it (its power consumption is minimal anyway). In Terminal, enter `sudo nano /etc/network/interfaces`. Find the first line that begins 'wpa-conf', and on a new line directly beneath it, above the 'allow-hotplug wlan1' line, type:

wireless-power off.

Press `⌘+x`, then `y` when prompted to save your changes. Close the Terminal window, then reboot your Pi Zero for the change to take effect. To verify your settings, enter `ifconfig` in Terminal. If there's no reference to power management, it has been disabled.

The final step of the process is simply to install a single app to enable AirPrint support, again from the command line: `sudo apt-get install avahi-discover`. Once done, that is literally it. On your iPad or iPhone you should find your printer is now visible as an AirPrint destination and, crucially, that it works.

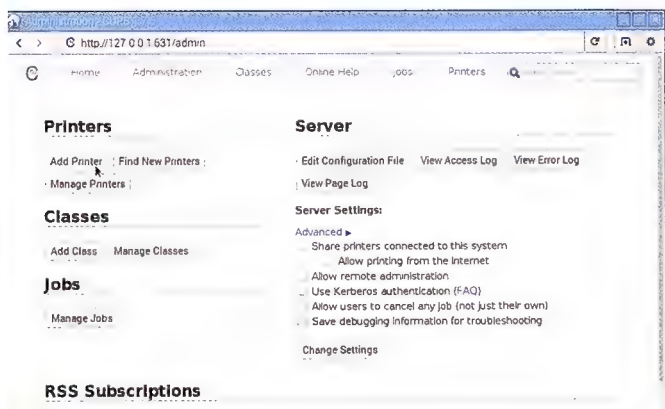
MAKE IT HEADLESS

There's no need to keep the keyboard or monitor connected now, but it's handy to perform a few tweaks should you need to access the Pi Zero later on.

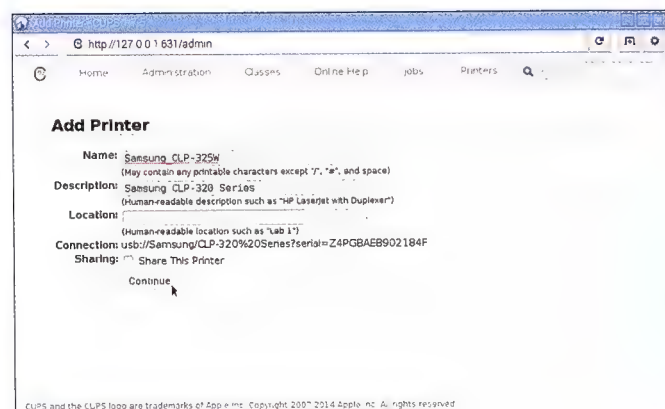
First, support for command-line access via your Mac's Terminal app is already set up – just enter the following command to log on: `ssh pi@raspberrypi.local` and enter yes when prompted, followed by your password, which is raspberry, and you'll find yourself at the Pi's command line. If you want remote access to the Pi's graphical desktop, you'll need to install VNC software on it.

You can now shut down your Pi Zero, disconnect the keyboard and monitor, then power it back up. Congratulations, your printer is now AirPrint-enabled and easily accessible from other computers too.

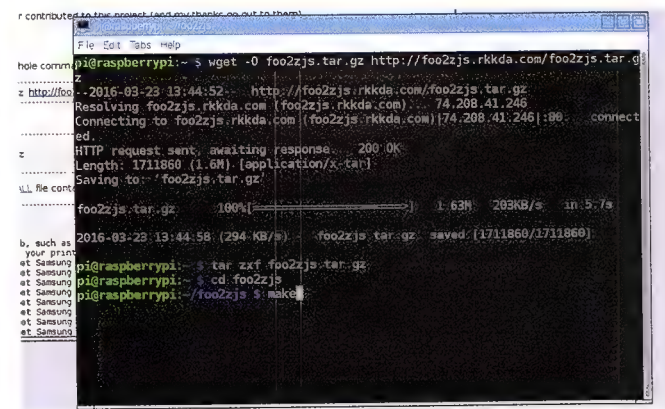
How to install your USB printer



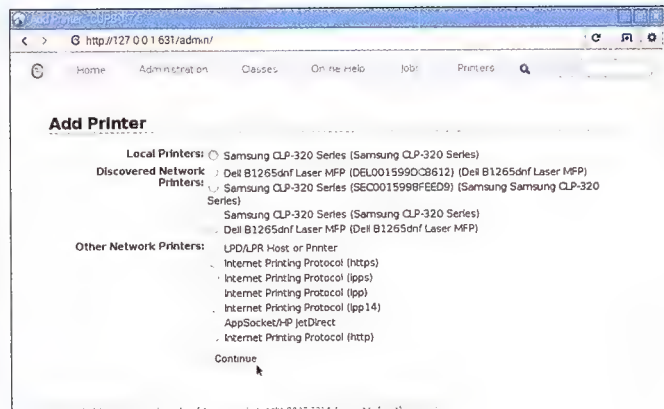
1 ACCESS CUPS
In the menu bar, choose 'Menu > Internet > Epiphany Web Browser'. Type 127.0.0.1:631 into the browser's address bar and then press Enter to access the CUPS management interface. Switch to its Administration tab and then click 'Add Printer'.



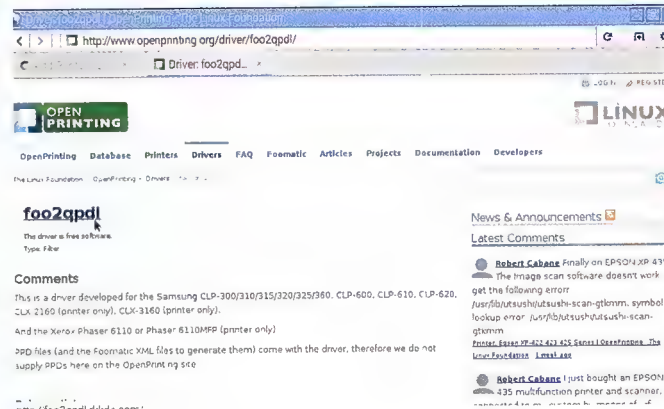
3 CHECK FOR A DRIVER
You can change the printer's name if you want, but make sure you click the checkbox next to Share This Printer before you click Continue again. CUPS will provide you with a list of available printer drivers – if one for your model is present, select it; if not, read on.



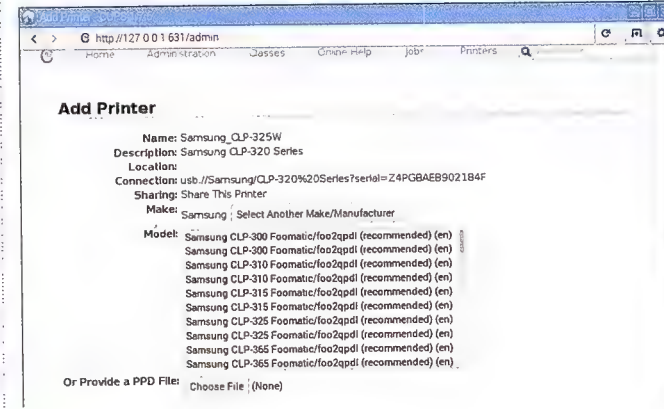
5 INSTALL THE DRIVER
You may have to download and then compile the driver – instructions for doing this are provided on the website you got the driver from. Follow the instructions carefully, but be reassured that although they look complicated, it's mostly a copy and paste job.



2 SELECT YOUR PRINTER
Enter your user credentials (unless you've customised them, the username is pi and the password is raspberry), then click OK. Your printer should be listed under 'Local Printers' and/or 'Discovered Network Printers'. Select your desired connection and click Continue.



4 MANUALLY FIND A DRIVER
Open a new browser tab, then try your printer maker's website, or visit openprinting.org/printers where you can browse by make and model to look up a recommended driver, which is listed at the top. Switch to the Drivers tab to locate links to the recommended driver.



6 FINISH ADDING THE PRINTER
Switch back to the tab in Epiphany where you were adding a printer. Reload the page and entries relating to your printer will appear. Select one and then click Add Printer. Switch to CUPS's Printers tab to select Maintenance > 'Print Test Page' and check it's all working. ■

Create a speed dial for your iPhone

Matthew JC. Powell explores a long-forgotten aspect of iOS for a bit of non-jailbreak customisation.

Remember web apps? They were never that big a thing here because by the time Australia got the iPhone we also got the App Store, but before the App Store if you wanted to develop an app for the iPhone what you developed was a web app.

They were great, because anybody could develop them with a bit of know-how, and anybody could install them from anywhere — total freedom. The limitation was that they couldn't access the hardware of the iPhone directly, so they had limited capabilities. Nonetheless, that was what Apple planned for the iPhone: Apple could create native apps, and everyone else could create web apps. Naturally there was resistance from developers who wanted to create native apps.

When Steve Jobs relented and allowed an iPhone SDK to be released, developers leapt at the opportunity — but of course you could only get them through Apple. Web apps were effectively sandboxed because they

ran inside Safari, while native apps would be a much greater security risk, so Apple appointed itself gatekeeper.

It's the balance of freedom and security under which we all live our daily lives.

Interestingly, though, web apps do still exist for iOS, and a few enterprising developers have leveraged them to make ad hoc scripting tools not dissimilar to Automator, Apple's tool for scripting automation on the Mac. Within the limitations of running inside Safari, they can be quite capable and useful.

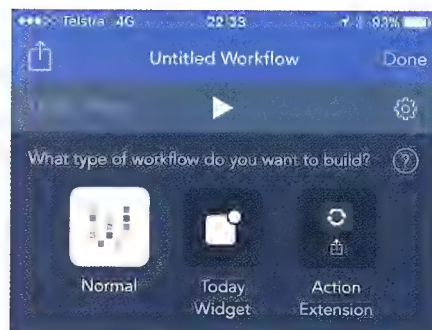
For this tutorial we're going to build a very simple script using a tool called Workflow, which you can download

from the App Store for \$4.49 (and it's worth every cent). We'll look at other similar tools in future issues.

When you run Workflow, you're given the option to 'Check out the workflow gallery' (which is worth doing, as there are some pretty smart ideas there) or to create a new workflow from scratch. We're going to create one from the ground up, as none of the examples in the gallery do quite what we want. Tap the + symbol in the upper-right corner.

Next, choose what kind of workflow you're going to create. Since we're simply going to create a web app that sits on the Home screen, that's a 'Normal' workflow. 'Today Widget' workflows are rather nifty in

"When Steve Jobs relented and allowed an iPhone SDK to be released, developers leapt at the opportunity — but of course you could only get them through Apple."

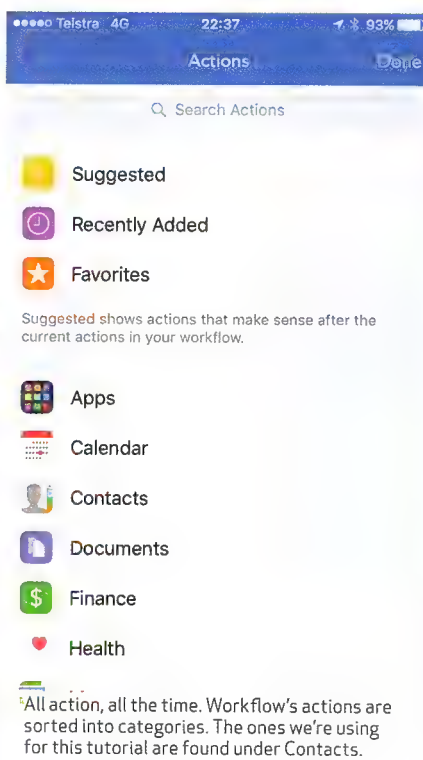


Drag actions from the left to build your workflow.

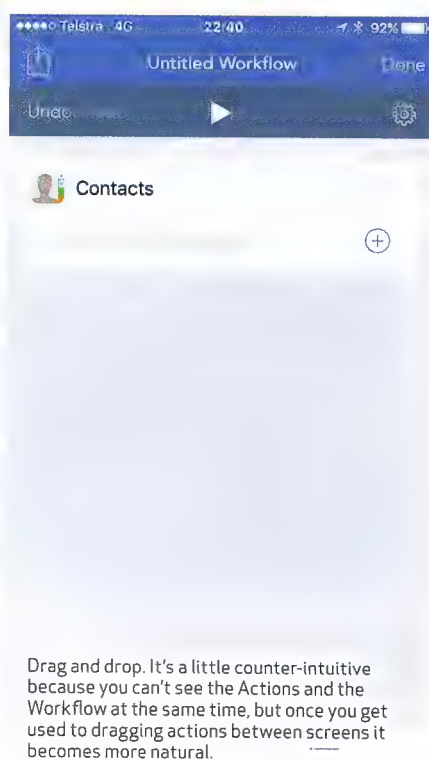


Start here. The Workflow window, into which you drag your various actions.

Workflow

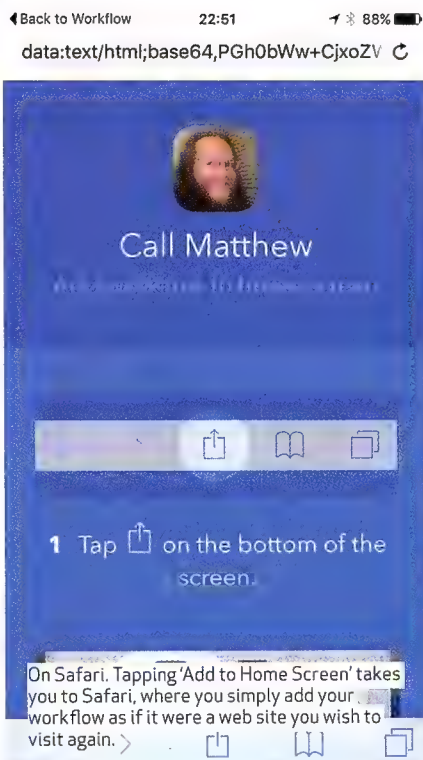


All action, all the time. Workflow's actions are sorted into categories. The ones we're using for this tutorial are found under Contacts.



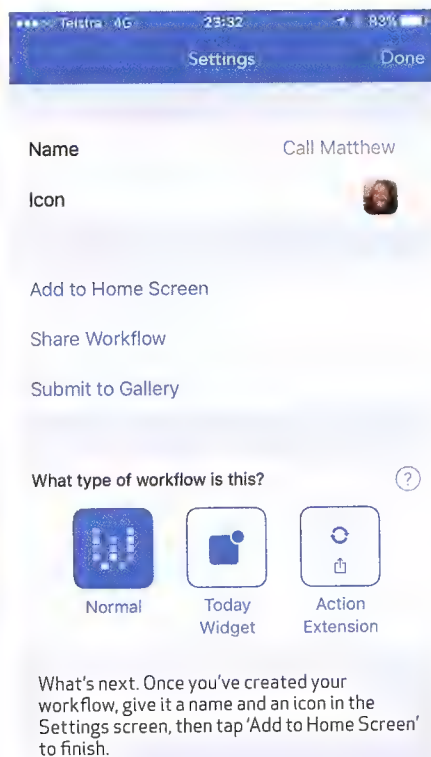
Drag and drop. It's a little counter-intuitive because you can't see the Actions and the Workflow at the same time, but once you get used to dragging actions between screens it becomes more natural.

Workflow



themselves, as instead of sitting on the Home screen they are to be found in the Notification Centre when you drag down from the top of the screen, but that's for another time.

You may be a little confused at this point by the on-screen instruction to 'Drag actions from the left to build your workflow'. There is, of course, nothing visible on the left like the Action library in Automator. However, slide your finger to the right on the



screen, and you'll see that to the left of the Workflow window there are indeed a bunch of actions you can drag.

For this simple script, grab the action called Contacts and drag it to the right. This will place it on the Workflow window. Tap the + symbol to choose a contact you wish to be able to dial quickly.

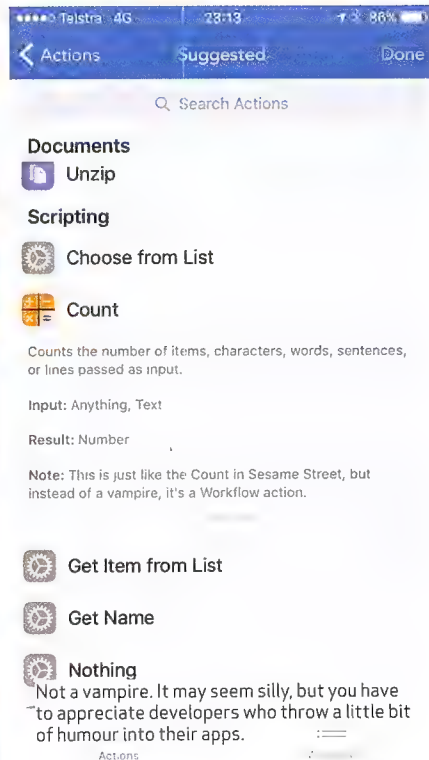
Next, swipe to the right again to return to the list of actions. This time, grab Call and drag it to the right. Make sure to drop it below the Contacts action.

Congratulations, you've created a workflow. If you want to, you can tap the play icon (the little right-facing triangle) to run it. Your iPhone should call your chosen contact.

You're not done yet, though. Next, give your workflow a name. To do this, tap on the little got-wheel icon near the upper-right of the screen, which is your workflow's settings. Tap in the field for Name and then type in the name as you would like it to appear on the Home screen. Something like 'Call <name of contact>' is probably best.

Next, tap on the field for Icon, and you'll be taken to the icon-creation screen. You can choose from a range of stock glyphs and coloured backgrounds, or you can choose a photo from your photo library to use as an icon. For a contact speed dial shortcut like this, that's probably wisest. When you've got your icon sorted, tap Done to go back to settings.

Next (and this is the fun part) tap 'Add to Home Screen' to complete the process. This will actually take you out to Safari and insert a bunch of arcane-



looking text in the URL field. Remember, this is creating an actual running web app, so your workflow looks, to your iPhone, just like any URL shortcut you might put on your Home screen from Safari.

The process, therefore, is identical. Tap on the Action icon in the bottom toolbar (that's the square with an arrow coming out of it). Then choose the action Add To Home Screen and, on the following screen, simply tap Add. (Notice that this final screen tells you that 'An icon will be added to your home screen so you can quickly access this website' — as far as Safari is concerned, it's like any other shortcut.)

And just like that, your icon appears on your home screen. When you tap it, it launches Safari, which in turn calls on Workflow, which then runs the script. Unfortunately this means that if you want to share your script with anyone they also need to have installed Workflow.

So what's the use of this script anyway? Why not just use the Favourites menu or even Siri to call contacts quickly?

Well, if you've got elderly or less-mobile relatives who have trouble making their way around the iPhone's menus, a simple one-touch way to get in touch with an emergency contact might be just the thing. What's more, using this technique you can create a bunch of icons for relatives, doctors and others who might be needed. Installing Workflow on their iPhones might be a very good investment indeed (especially if you explore some of its other capabilities). ■

Run Ubuntu Linux on a tablet

Nick Peers digs deep to discover how to successfully install a working version of Ubuntu on a Windows 2-in-1 tablet.

Are you jealous of the sudden proliferation of cheap Windows 2-in-1 tablets? Wish you could run Linux on it instead? Spanish smartphone manufacturer, BQ, may be teaming up with Canonical to sell the Aquaris M10 tablet with Ubuntu pre-installed, but with the price tag expected to be north of US\$350, why pay more when it turns out you can – with a fair amount of tweaking – get Linux to install on a cheap Windows device?

These devices all use a low-end Intel Atom quad-core processor known collectively as Bay Trail, and we managed to source one such tablet, which we've made the focus of this tutorial. The device we've used for this tutorial is a Linx 1010, which sports an Atom Z3735F processor, 2GB RAM, 32GB internal EMMC (plus a slot for additional microSD card), two full-size USB ports and a touchscreen with multi-touch support. You can find similar models with detachable keyboard and trackpad for around \$400-\$500 in Australia. These devices come with Windows 10 pre-installed, but as you'll discover, it's possible to both run and install flavours of Linux on them.

In a perfect world, you'd simply create a live Linux USB drive, plug it in and off you go, but there are a number of complications to overcome. First, these tablets pair a 64-bit processor with a 32-bit EFI – most distros expect a 64-bit processor with 64-bit EFI, or a 32-bit processor with traditional BIOS, so they won't recognise the USB drive when you boot. Second, while hardware support is rapidly improving with the latest kernel releases, it's still not particularly comprehensive out of the box. But don't worry – if you're willing to live with reduced functionality for now (things are improving on an almost daily basis) you can still get Linux installed and running in a usable setup using a Bay Trail-based tablet. Here's what you need to do.

It pays to take a full backup of your tablet in its current state, so you can restore it to its original settings if necessary. The best tool for the job by far is a free Windows application called Macrium Reflect Free (www.macrium.com/reflectfree.aspx). Install this on your tablet, then back up the entire disk to your tablet's microSD storage before creating a failsafe Macrium

USB bootable drive for restoring the backup if required. Note: The microSD slot can't be detected by the rescue disc, so to restore your tablet to its default state you'll need a USB microSD card reader, which can be detected by the Macrium software.

With your failsafe in place, it's time to play. While they're very similar, Bay Trail tablets aren't identical, so it's worth searching for your tablet model and a combination of relevant terms ('Linux', 'Ubuntu' and 'Debian' etc) to see what turns up. You're likely to find enthusiasts such as John Wells (www.jfwhome.com), who has detailed guides and downloadable scripts to getting Ubuntu running on an ASUS Transformer T100 tablet with most of the hardware working. Another good resource is the DebianOn wiki (<https://wiki.debian.org/InstallingDebianOn>) where you'll find many other tablets are featured with guides to what works, what issues to look out for and handy links and downloads for further information.

Sadly – for us – there's no handy one-stop shop for the Linx 1010 tablet, so we had to do a fair bit of experimenting before we found the best way forward for us.

INSTALL LINUX ON LINX

We decided to go down the Ubuntu route when it came to the Linx 1010 tablet. We're indebted to the hard work of Ian Morrison for producing a modified version of Ubuntu (14.04.3 LTS) that not only serves as a live CD, but also works as an installer. We experimented with later Ubuntu releases – 15.10 and a daily build of 16.04 – but while the live distros work fine, installing them proved to be impossible. Still, all is not lost, as you'll discover later on. So, the simplest and easiest way to install Ubuntu on your Z3735F-powered tablet is to use Ian's Unofficial 'official' quasi Ubuntu 14.04.3 LTS release. This comes with 32-bit UEFI support baked in to the ISO, and includes custom-built drivers for key components including the Z3735F processor and the internal Wi-Fi adaptor. However, there's no



touchscreen support, so you'll need to connect the tablet to a detachable keyboard and touchpad.

Go to www.linuxium.com.au on your main PC and check out the relevant post (dated 12 August 2015, but last updated in December) under Latest. Click the Google Drive link and select the blue Download link to save **Ubuntu-14.04.3-desktop-linuxium.iso** file to your Downloads folder.

Once done, pop in a freshly formatted USB flash drive – it needs to be 2GB or larger and formatted using FAT32. The simplest way to produce the disk is to use UNetbootin and select your flash drive, browse for the Ubuntu ISO and create the USB drive. Once written, eject the drive. Plug it into one of the Linx's USB ports, then power it up by holding the power and volume + buttons together. After about five seconds or so you should see confirmation that boot menu is about to appear – when it does, use your finger to tap Boot Manager. Use the cursor key to select the 'EFI USB Device' entry and hit Return to access the Grub menu. Next, select 'Try Ubuntu without installing' and hit Return again.

Hardware support

What's the current state of play for hardware support for Bay Trail tablets? It varies from device to device, of course, but there are differences. Here's what you should be looking for when testing your tablet:

ACPI

This deals with power management. This is practically non-existent out of the box, but later kernels do tend to produce support for displaying battery status – the Linx appears to be the exception to the rule here. Suspend and hibernation should be avoided.

Wi-Fi

Later kernels again improve support, but many devices use SDIO wireless adaptors, which aren't supported without patches or custom-built drivers like those found at <https://github.com/hadess/rtl8723bs>.

Bluetooth

This often needs patching with later kernels, although our Linx tablet retained Bluetooth connectivity

throughout, even when the internal Wi-Fi adaptor stopped working.

Sound

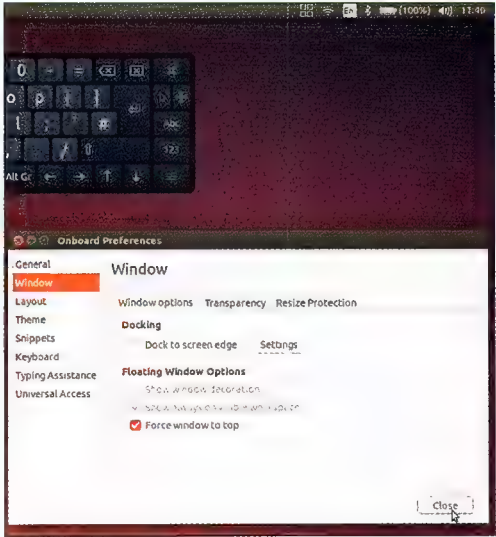
A problem on many tablets, and even if the driver is recognised and loaded, required firmware may be missing. Be wary here – there are reports of users damaging their sound cards while trying to activate them.

Touchscreen

As we've seen, older kernels don't support them, but upgrading to kernel 4.1 or later should yield positive results, albeit with a bit of tweaking.

Camera

There's been little progress made here so far. In most cases you'll need to wait for drivers to appear.



Upgrade the kernel to 4.1 or later to make Ubuntu touch-friendly on your tablet.

You'll see the Ubuntu loading screen appear and then after a lengthy pause (and blank screen) the desktop should appear. You should also get a momentary notification that the internal Wi-Fi adaptor has been detected – one of the key indications that this remixed Ubuntu distro has been tailored for Bay Trail devices.

Up until now you'll have been interacting with your tablet in portrait mode – it's time to switch it to a more comfortable landscape view, and that's done by click the Settings button in the top right-hand corner of the screen and choosing System Settings. Select Displays, set the Rotation drop-down menu to Clockwise and click Apply (the button itself is largely off-screen, but you can just make out its left-hand end at the top of the screen).

Next, connect to your Wi-Fi network by clicking the wireless button in the menu bar, selecting your network and entering the passkey. You're now ready to double-click 'Install Ubuntu 14.04.3' and follow the familiar wizard to install Ubuntu on to your tablet. You'll note that the installer claims the tablet isn't plugged into a power source even though you should have done so for the purposes of installing it – this is a symptom of Linux's poor ACPI support for these tablets.

We recommend ticking 'Download updates while installing' before clicking Continue, at which point you'll probably see an Input/output error about fsyncing/closing – simply click

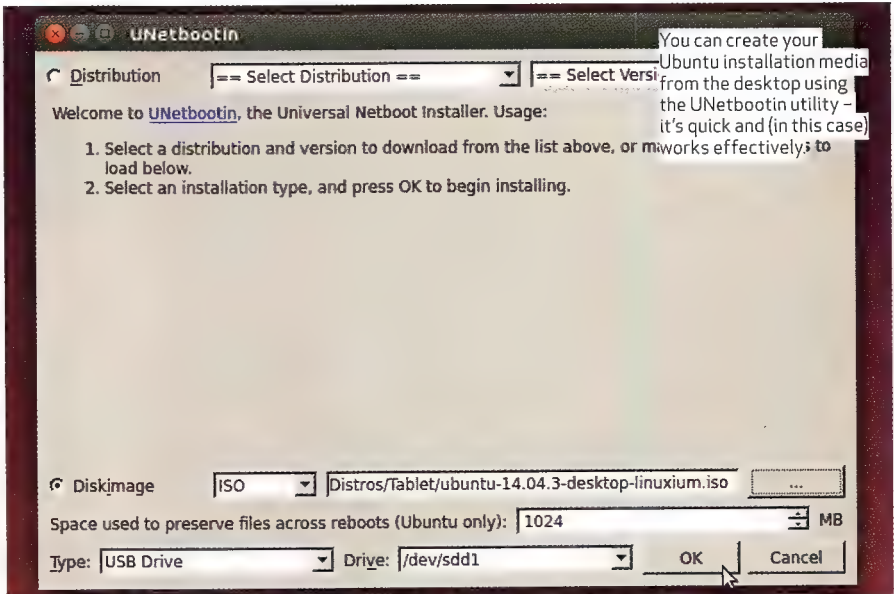
Ignore and then click Yes when prompted to unmount various partitions.

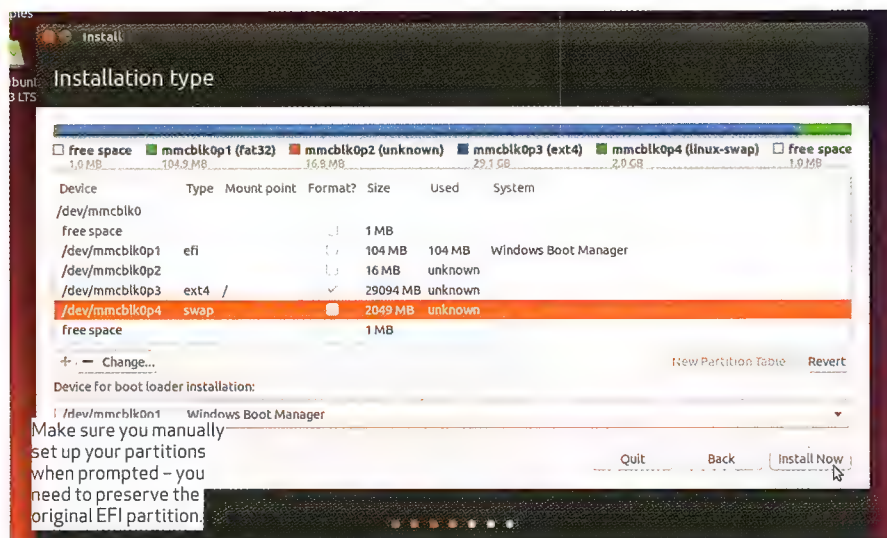
At the partition screen you'll see what appears to be excellent news – Ubuntu is offering to install itself alongside Windows, but this won't work, largely because it'll attempt to install itself to your microSD card rather than the internal storage. This card can't be detected at boot up, so the install will ultimately fail. Instead, we're going to install Ubuntu in place of Windows, so select 'Something else'.

Ignore any warning about `/dev/sda`

– focus instead on `/dev/mmcblk0`, which is the internal flash storage. You'll see four partitions – we need to preserve the first two (Windows Boot Manager and unknown) and delete the two NTFS partitions (`/dev/mmcblk0p3` and `/dev/mmcblk0p4` respectively). Select each one in turn and click the '-' button to delete them.

Next, select the free space that's been created (31,145MB or thereabouts) and click the '+' button. First, create the main partition – reduce the allocation by 2,048MB to leave space for the swap partition, and





set the mount point to '/', but leave all other options as they are before clicking OK. Now select the remaining free space and click '+' for a second time. This time, set 'Use as' to 'swap area' and click OK. Finally, click the 'Device for bootloader installation' dropdown menu and select the Windows Boot Manager partition before clicking 'Install Now'. The rest of the installation process should proceed smoothly. Once it's finished, however, don't click 'Continue testing or Reboot now' just yet. First, there's a vital step you need to perform in order to make your copy of Ubuntu bootable, and that's install a 32-bit version of the Grub 2 bootloader. The step-by-step walkthrough (see the bottom of page 91) reveals the simplest way to do this, courtesy of Ian Morrison's handy script.

HARDWARE COMPATIBILITY

Once you've installed Ubuntu and rebooted into it for the first time, you'll once again need to set the desktop orientation to landscape via Screen Display under System Settings. Now open Firefox on your tablet and download two more scripts from bit.ly/z3735fpatch and bit.ly/z3735f-dsdt respectively. Both improve the hardware support for devices sporting the Linx 1010's Z3735F Atom chip, and while they don't appear to add any extra functionality to the Linx, they do ensure the processor is correctly identified.

You need to `chmod` both scripts following the same procedure as outlined in step 2 of the Grub step-by-step guide (page 91), then install them one after the other, rebooting between each. Finally, download and install the

latest Ubuntu updates when offered.

You'll notice the login screen reverts to portrait mode when you first log in – don't worry, landscape view is restored after you log in, and you can now review what is and isn't supported on your tablet. In the case of the Linx 1010, not an awful lot is working at this point. There's no ACPI support, the touchscreen isn't detected, and there's no camera support or sound (although the sound chip is at least detected). The internal Wi-Fi is thankfully supported, as are the USB ports, Bluetooth, keyboard/trackpad and internal flash.

Later versions of the kernel should improve compatibility – this is why we were keen to see if we could install Ubuntu 15.10 or 16.04 on the Linx. We were thwarted in this respect – touch support is present, but we had to manually add the `bootia32.efi` file to the `EFI/Boot` folder to get the live environment to boot, and installation failed at varying points, probably due to the spotty internal flash drive support. We're hoping the final release of 16.04 may yield more possibilities, but if you can't wait for that and are willing to run the risk of reduced stability read on.

If you're desperate to get touchscreen support for your tablet, and you've got a spare USB Wi-Fi adaptor handy (because updating the kernel breaks the internal Wi-Fi adaptor), then upgrade your kernel to 4.1 or later. We picked kernel 4.3.3 – to install this, type the following into a Terminal:

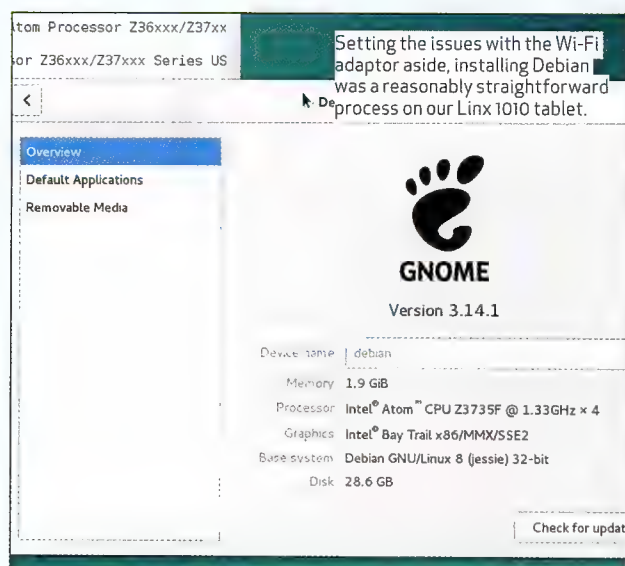
```
# cd /tmp
# wget -k kernel.ubuntu.com/~kernel-ppa/mainline/
```

Experimenting with Linux

The only other distro we were able to install successfully on the Linx 1010 tablet was Debian Jessie (8.3). It's unique in that both 32-bit and 64-bit versions work with 32-bit UEFI without any modification, but there's no live support: you'll have to install it direct to the hard drive.

Wi-Fi support isn't provided out of the box – we had to add a non-free firmware package to the USB flash drive to get our plug-in card recognised. Hardware support was minimal, although upgrading to kernel 4.2 did at least allow the internal Wi-Fi adaptor to be recognised.

Elsewhere we tried the Fedlet remix of Fedora (<http://bit.ly/fedora-fedlet>) as a live USB, but had to use a Windows tool (Rufus) to create the USB flash drive in order for it to boot. Performance was extremely sluggish, and the internal Wi-Fi adaptor wasn't recognised. Touch did work, however. We also had success booting from a specialised Arch Linux ISO that had SDIO Wi-Fi and 32-bit UEFI support. You can get this from <http://bit.ly/arch-baytrail>, but stopped short of installing it. We also got a version of Porteus up and running from <http://build.porteus.org> with a lot of fiddling, but the effort involved yielded no better results than anything else we tried.




```
v4.3.3-wily/linux-head
rs-4.3.3-040303_4.3.3-
040303.201512150130_all.
deb
$ wget kernel.ubuntu.com
/~kernel-ppa/mainline/
v4.3.3-wily/linux-headers-
4.3.3-040303-generic_
4.3.3-040303.
201512150130_amd64.deb
$ wget \kernel.ubuntu.com
/~kernel-ppa/mainline/v4.3.3
-wily/linux-image-4.3.3-040303
-generic_4.3.3-040303.
201512150130_i386.deb
$ sudo dpkg -i linux-
headers-4.3*.deb linux-
image-4.3*.deb
```

Once complete, reboot your tablet. You'll discover you now have touch support at the login screen (this is single touch, not multi-touch), but once you log in and the display rotates you'll find it no longer works correctly. We'll fix that shortly.

First, you need to be aware of the drawbacks. You'll lose support for the internal SDIO wireless card (we had to plug in a spare USB Wi-Fi adaptor to get internet connectivity back) and the sound is no longer recognised. There may also be issues with stability that you can fix with a rough and ready workaround by configuring Grub:

```
$ sudo nano /etc/default/grub
Look for the line marked GRUB_
CMDLINE_LINUX_DEFAULT and
change it to this:
GRUB_CMDLINE_LINUX_
DEFAULT="intel_idle.max_
cstate=0 quiet"
```

Save your file, exit Nano and then type in:

```
$ sudo update-grub
```

Reboot, and you'll reduce the potential for system lockups, but note the kernel parameter increases power consumption and impact on battery life, which is a shame because the ACPI features still don't work, meaning that the power settings remain inaccurate: battery life is always rated at 100%, even when it's clearly not.

FIX THE TOUCHSCREEN

Moving on, let's get the touchscreen working properly. First, identify its type using `xinput`. In the case of the Linx 1010, this reveals it has a Goodix Capacitive TouchScreen. What we need to do is instruct the touchscreen to rotate its matrix when the display does, which means it'll work in both portrait and landscape modes. You can do this using `xinput`:

```
xinput set-prop "Goodix
Capacitive TouchScreen"
'Coordinate Transformation
Matrix' 0 1 0 -1 0 1 0 0 1
```

You should now find the touchscreen works correctly in horizontal landscape mode. As things stand, you'll need to apply this manually every time you log into Ubuntu, while the touchscreen won't work properly if you rotate back to portrait mode. If you want to be able to rotate the screen and touchscreen together, then adapt the `rotate-screen.sh` script at bit.ly/RotateScreen (switch to Raw view, then right-click and choose 'Save page as' to save it to your tablet). Then open it in Gedit or nano to amend the following lines:

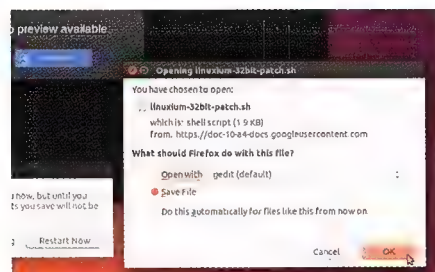
```
TOUCHPAD='pointer:SINO
WEALTH USB Composite Device'
TOUCHSCREEN='Goodix
Capacitive TouchScreen'
Save and exit, then use the script:
$ ./rotate_desktop.sh
<option>
```

Substitute `<option>` with normal (portrait), inverted, left or right to rotate both the screen and touchscreen matrix. Before using the script, you need to first undo the current screen rotation using Screen Display – restore it to its default view, then run `./rotate_desktop.sh` right to get touchpad and touchscreen on the same page.

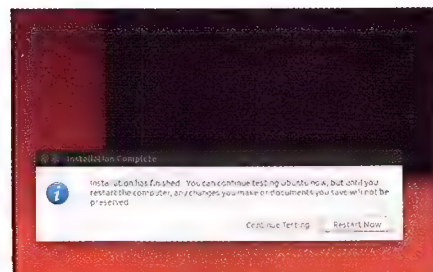
From here we suggest creating a startup script: open dash and type `startup`, then launch Startup Applications. Click Add. Type a suitable name etc to help you identify it, click 'Browse' to locate and your select your script – when done, click inside the Command box and be sure to append `right` to the end of the script. Click Save, reboot and after logging in you should find your tablet and touchscreen now work beautifully with your plug-in keyboard and touchpad.

You've now successfully installed Ubuntu on your Bay Trail tablet. What next? Keep an eye out for the latest kernel updates and forums to see if entrepreneurial folk have found the workarounds and tweaks required to get more of your tablet's hardware working properly. As for us, we're off to see if we can get the internal sound and Wi-Fi working again before turning our attention to the ACPI settings...

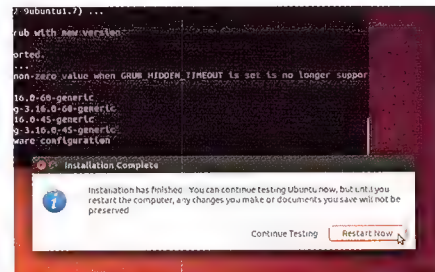
Install the 32-bit Grub bootloader



1 DOWNLOAD INSTALL SCRIPT
When Ubuntu has finished installing to your tablet, make sure the dialogue asking if you'd like to continue retesting or restart your PC is kept on-screen. Now open the Firefox browser and navigate to <http://bit.ly/grub32bit>, which will redirect to a Google Drive download page. Click Download to save the `linuxium-32bit-patch.sh` to your Downloads folder.



2 INSTALL SCRIPT
The `linuxium-32bitpatch.sh` file is a script that automates the process of installing the 32-bit version of the Grub 2 bootloader. Now you'll need to press Ctrl-Alt-T and type the following commands:
\$ cd Downloads
\$ chmod 700 linuxium-32bit-patch.sh
\$ sudo ./linuxium-32bit-patch.sh



3 REBOOT PC
You'll see a series of packages are downloaded and installed automatically, which will basically allow your tablet's 32-bit UEFI to recognise the Grub bootloader, and allow Ubuntu to load automatically at startup. Click the 'Restart Now' button to complete the process and wait while your PC reboots into Ubuntu proper for the first time. ■



"There's no such thing as the perfect PC, because that would be different for all of us, but what if you wanted to push the limits"

Build a custom water-cooled mini PC

A little water cooling here, a radiator or two there, and one hell of a lot of processing power. Zak Storey.

For the PC enthusiast in today's climate, our work has never been as diverse, as interconnected. Just take a step back for a moment, and consider how much more you do on your system now than, say, 10 years ago. We game, we render, we design, we write, we create, we produce. There's no such thing as the perfect PC, because that would be different for all of us, but what if you wanted to push the limits, to reach beyond the mundane, and to take aesthetic design style and blend it with the craziness of computational processing power?

Well, that's what we're aiming to do here. The idea is to build an insanely powerful ITX system, full of the best and the most brilliant hardware we could find to satisfy all of those different needs. So we can push four million AAA pixels in-game, render 4K videos, record audio, and do our work in complete silence, while retaining a beautiful system you'd be proud to showcase on your desk.

HARDLINE LIQUID COOLING

Ultimately, this build was all about encapsulating the feel of our Dream Machines, while condensing it down into a smaller, more affordable form factor. Liquid cooling was our first port of call, and we chose the NZXT Manta to house all of our meaty hardware. The backbone of this rig, we decided, was going to be the ASUS Z170i Pro Gaming, thanks to its easily moddable heatsinks and hidden M.2 slot. On top of that we chose an Intel Core i7-6700K which we managed to overclock up to 4.8GHz.

For graphical processing, we went for an Radeon R9 Fury X. The Fury X's High Bandwidth Memory will work a treat, and thanks to some amazing tomfoolery from EKWB's design team, once the waterblock is attached, it's actually a single-slot card.

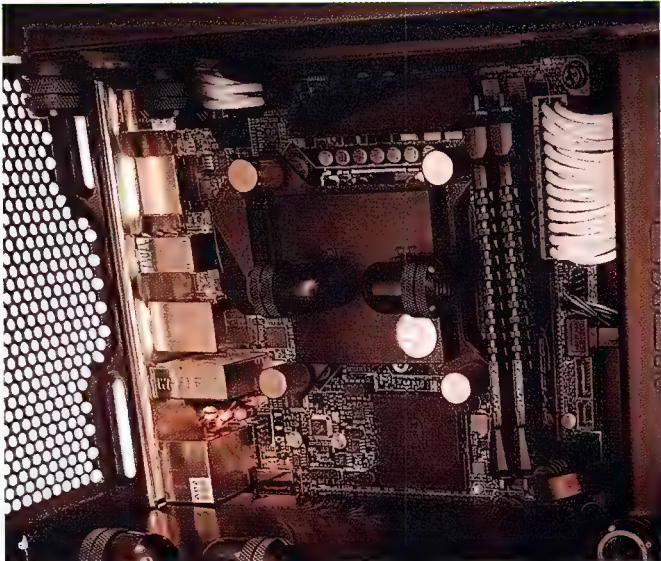
Then we threw 32GB of HyperX Savage 2,666MT/s DDR4 into the mix – brilliant capacity and performance, though the kit we had on hand hasn't landed down under yet, so you may need to opt for HyperX's equivalent Fury kit instead. For storage, we opted for a Samsung 950 Pro 512GB M.2 SSD for the operating system, and a further 1TB of storage from the OCZ Trion 100 SSD we still had kicking around the office. More than enough super-fast storage to sink your teeth into.

PARTS LIST		
PART		STREET PRICE
CASE	NZXT MANTA	\$200
MOTHERBOARD	ASUS Z170I PRO GAMING	\$290
CPU	INTEL CORE I7-6700K @ 4.8GHZ	\$530
MEMORY	HYPERX SAVAGE 32GB (2 X 16GB) 2,666MT/S	\$430
GPU	RADEON R9 FURY X	\$800
PSU	CORSAIR AX1200I	\$460
SSD 1	SAMSUNG 950 PRO 512GB	\$430
SSD 2	OCZ TRION 100 960GB	\$340
WATERCOOLING & ACCESSORIES	WATERBLOCKS, PIPING, RADIATORS, RESERVOIRS, FITTINGS, COOLANT, AND FANS	\$1,565
TOTAL		\$5,045

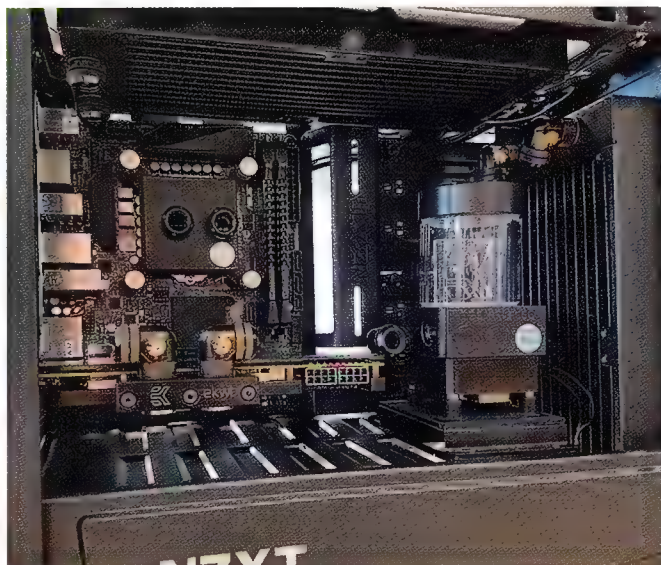
"To get the colour scheme we wanted, it was a simple case of taking the heatsinks off, masking off everything except the red accents, and then applying a couple of layers of Plasti Dip to hide those colour-clashing gaming stripes."



1 CHOOSING THE PERFECT CASE
The first thing you have to consider whenever you're about to embark on a water-cooled adventure is what chassis you're going to house your new machine in. The bigger rigs tend to be easier to work in, on the whole, because there's more room inside for you to fiddle around, but for us, ITX was the name of the game. NZXT's Manta looks stunning, and can house a 36mm-deep 240mm rad in the roof, and a meatier 240mm in the front, as well. The only problem was deciding where to mount the res. In the end, we had to drill into the floor, just to the right of the GPU, to add a mounting point for a Phanteks Evolv pump/res mount for our EKWB DDC combi. It still looks classy, and gave us just enough room to manoeuvre in. Although we're pretty thankful we didn't opt for a longer graphics card here....



2 SPRAYING THE MOTHERBOARD
Getting the perfect motherboard for this build was particularly difficult. The trick was to find a traditionally oriented Z170 ITX board, with power connectors in the correct place, an M.2 slot, and the whole thing styled in black. Unfortunately, being so choosy left us with very few options. In the end, we decided to compromise a little on the colour, and go with the Z170i Pro Gaming. To get the colour scheme we wanted, it was a simple case of taking the heatsinks off, masking off everything except the red accents, and then applying a couple of layers of Plasti Dip to hide those color-clashing gaming stripes. Because Plasti Dip is a natural insulator, spraying only over the red accents would ensure we wouldn't be plagued by ridiculously high VRM temps, which we would have ended up with if we had sprayed the entirety of the heatsinks.



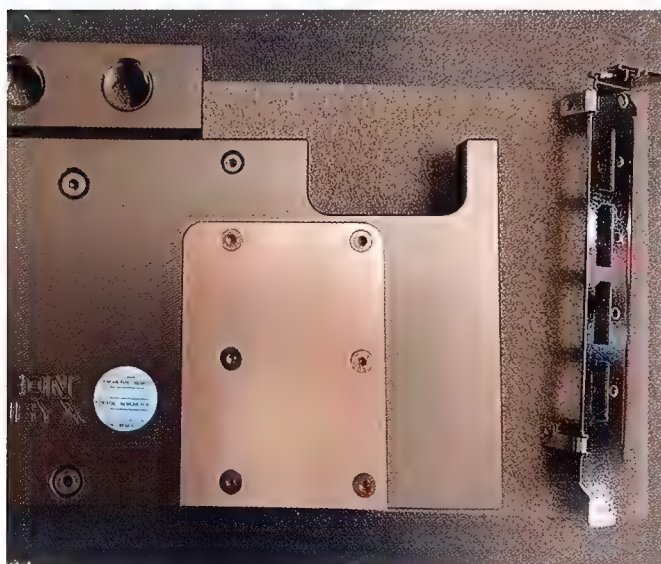
3 PLANNING TUBING RUNS

Tubing runs are always going to be tricky to plan in advance — the best advice we can give you is to invest in some angled rotary fittings, especially for hard tubing. They make life so much easier once everything is in your hands. When building any water-cooled rig, you should go through two separate builds. The first to ensure all of your hardware works prior to attaching waterblocks. Then the second prefit just to see where all of your hardware will lie, and what runs you may have to do. In our case, this was incredibly useful, because we learned pretty quickly that our initial idea to mount the combi reservoir to the radiator just wasn't going to work in such a tight chassis.



4 SUPER-STEALTH STORAGE

You know what we like more than alliteration? Hidden storage. And that's what we managed to achieve fairly seamlessly. The inclusion of an M.2 slot on the rear of the ASUS Z170i Pro Gaming is a godsend — although incredibly inaccessible once installed in a water-cooled loop, it's a great way of keeping your M.2 drives cool and out of the way, avoiding any potential eyesores. For our 1TB drive, we simply hid that way down below the PSU cover. Annoyingly, NZXT's SSD mounting points place most SSDs upside down, as far as the label goes, and that's just not good enough for this aesthetic build. Still, it's the performance and capacity we're after — we're already glamorous.



5 SINGLE-SLOT GPUS

The dream, the ambition, the single-slot, water-cooled flagship card. EKWB provides a stunning, clean single-slot adapter with its Fury X waterblock, enabling the Fury X to be a truly beautiful, compact powerhouse. Couple that with a full cover backplate, and oof! Well, we'll let the photography do the talking. When installing GPU waterblocks, follow the instructions to the letter; there's no messing around here. If you don't make the right contacts here with the block, you can end up short-circuiting your card, or worse. That said, EKWB's EK-FC Fury X block was quite straightforward — the hard part was removing that noisy stock cooler off the original Fury X.



6 FILLING THE LOOP

Filling any loop requires forethought and planning; there are always two things you have to consider. Firstly, where your fill port is going to be, and secondly, to ensure that your pump is gravity-fed. Running your pump dry is one of the worst things you can do, as the coolant acts as a natural lubricant for the ball bearing situated in the turbine. To save on size and to ensure this didn't happen, we opted for an EKWB DDC combi pump reservoir; its overall small form factor is a lifesaver for this build, and by mounting it on the bottom of the chassis, we have easy access to the top fill port for inserting our pearly white coolant. Perfect.



- 1 We actually opted for two NZXT Mantas for this build. We loved the white variant, but the half black/white interior really clashed with the idea we wanted to bring to life here.
- 2 Although the Manta technically supports two 280mm radiators, you have to bear in mind that the top will only support radiators up to 36mm in depth. We opted for an EKWB CoolStream SE 240mm for the roof, and a PE 240mm for the front of the chassis.
- 3 Interior lighting is produced thanks to a Bitfenix Alchemy 30cm white LED strip, and two sets of dual 3mm white LEDs. These help bring attention to our hardware, and really make the interior pop.
- 4 For fans, we decided to opt for four Noctua NF-F12 IPPC variants, spinning at 2,000rpm. The best of the best, these babies are super-silent at a low rpm, incredibly powerful, and — most importantly for Noctua — black.

Performance in an attractive package

Finishing building this monster gave us a greater understanding and appreciation of hardline water cooling. As a rookie, it can be daunting, especially when you first start bending your tubing. It's difficult — you have to take a step back, deconstruct your system a few times, and decide what's the best way to run various tubing lines in your chassis. It's definitely a labour of love, but once complete, it's hard to argue that it doesn't look incredible.

But it's not all about how pretty your rig looks, but how it performs when pushed up against that rendering grindstone, right? So, to clarify on our overclock stats, we achieved an impressively stable 5GHz on our Core i7-6700K, with 1.41V on CPU core voltage. We kept the 32GB (2x 16GB) HyperX Savage Black DDR4 at 2,400MT/s, because the increased frequency also increased the CAS latency, making it less than worthwhile. And we also left the Fury X at stock, because although it is possible to overclock the Fiji GPU inside, it's incredibly finicky to get stable enough, especially with high CPU overclocks.

All in all, this rig was quiet. Really quiet. Even under load, the most we saw was 60°C, and it still wasn't enough to make the fans kick in. As far as our rendering tests went, we were

impressed; 1,074 is nothing to shake your head at, especially for a 4/8 processor. Graphically, the Fury X is certainly a contender — if you're not looking to overclock, it's a solid 1440p card. In *Batman: Arkham City*, we scored a healthy 101fps, and both 4K titles scored frame rates in the high 40s. Dropping anti-aliasing would dramatically improve performance, as it's often unnecessary — certainly at such high pixel densities.

During the build, we came across a few problems, notably positioning the reservoir. If you want to utilise dual 240mm radiators in this build, attaching the reservoir to either via a bracket is a nightmare, and on top of that, a combo pump res just won't fit

mounted on the centre support beam. We had to ghetto mount our EKWB DDC pump on to the centre of a Phanteks pump mount from an Evolv ATX, then drill that into the chassis' mid plate.

For liquid cooling, the Manta is an incredible feat of engineering. The fact it isn't stymied by that traditional ITX size, ensuring you get the most out of your liquid cooling, is right up our alley. And as far as utilising a single PCIe slot goes? Well, most people don't use more than a single GPU, and for good reason: If you have the cash, you go for a better graphics card, as opposed to running SLI or CrossFire, and having to deal with the problems and slow updates associated with that.

BENCHMARKS

	APC LABS TEST PC	THIS SYSTEM
CINEBENCH R15 MULTITHREAD	1,387	1,074 (-23%)
CINEBENCH R15 SINGLE THREAD	128	213 (66%)
X264 HD 5.0 (FPS)	33.8	24.6 (-27%)
BATMAN: ARKHAM CITY @ 1440P (FPS)	204	101 (-50%)
TOMB RAIDER 4K (FPS)	87.5	46.8 (-47%)
SHADOW OF MORDOR 4K (FPS)	70.1	48.96 (-30%)
3DMARK FIRE STRIKE ULTRA	8,016	3,989 (-50%)

Our APC Labs Test PC uses a Core i7-5960X CPU, three GTX 980s, and 16GB RAM. *Arkham City* tested at 2560x1440 Max settings with PhysX off; *Tomb Raider* at Ultimate settings; *Shadow of Mordor* at Max settings. ■



Make a Mac Time Capsule with a Raspberry Pi

Learn how to build an inexpensive, Raspberry Pi-based networked backup drive. Lucy Hattersley

We're big fans of the Raspberry Pi. This tiny and inexpensive computer packs enough power to run Linux and can be used for many fun projects. We're going to make a Time Capsule using a Raspberry Pi 2 and an external hard drive. You'll need to download and install some extra software so the Pi can use a Mac-formatted drive and talk to Time Machine on your Mac. (Note, because this is an unofficial method, you shouldn't rely on it as your only backup.) This guide assumes that you've already got your Raspberry Pi up and running, with OS already installed.

With your hardware ready to go and Raspbian's desktop in front of you, choose Menu > Accessories > Terminal, which is similar to the Mac app of the same name. At its command line, enter `sudo apt-get update && sudo apt-get`

`upgrade` to make sure your installation is up to date. You'll see lines of text filling Terminal's window. This process will be finished when the scrolling stops and you see another coloured line of text that ends with a \$. Now we can get down to business with the various bits of required software. Portions of what follows are based on Caleb Woods' tutorial at <http://bit.ly/mfcwtc>.

GET THE PI TO READ A MAC DISK

First, download the tools Raspbian needs to work with Apple-formatted drives. In Terminal on the Pi, enter `sudo apt-get --assume-yes install hfsprogs hfsutils hfsplus` to download them.

To check where the drive is connected in the system, enter `sudo /sbin/parted` then, at this tool's own command line, enter `print` to get info about your external

drive. The command's output will include a line that starts with 'Disk /dev/sda' followed by the drive's capacity. Below that, a table should have two rows: find the one that refers to the partition named 'Time Machine' on the external drive – all being well it should be 2. This tells us /dev/sda2 is the location of the Time Machine partition. Enter `quit`.

We need Raspbian to mount the drive so we can use it. First, create a folder by entering `sudo mkdir -p /media/time_machine`. The last

Jargon Buster

`fstab` is a system configuration file that tells Raspbian about connected disks, whether to auto-mount them, and who should be able to write to them.



There are a few Raspberry Pi models. We'll use the Pi 2 Model B; an old 5W iPhone USB mains adaptor will power it.

"We're going to make a Time Capsule using a Raspberry Pi 2 and an external hard drive. You'll need to download and install some extra software so the Pi can use a Mac-formatted drive and talk to Time Machine on your Mac"

parameter there represents where the partition's file system will be mounted, much like the /Volumes folder in OS X.

Next you'll use a text editor, Nano, to edit a file that contains a list of all file systems we want the system to mount at startup. Enter `sudo nano /etc/fstab`. This file will contain several entries already. Below them (but above the lines starting with a # symbol), add the following text as a single line. (Where you see a gap in the text below, press the Tab key once, rather than the Spacebar.)

```
/dev/sda2    /media/time_
machine     hfsplus
force-rw,user,auto    0    0
```

Press Ctrl-O and then Enter to save your changes to the file, then press Ctrl-X to quit Nano. Now you're back at the command line, enter `sudo mount -a` to ensure the partition is mounted.

GET THE MAC AND THE PI TALKING
Next we'll install Netatalk. We need version 3.0 or higher, which we'll build

Quick Tip!

The apt-get command used in this project is a key part of Raspbian that's used to upgrade its components, and to install new packages.

from source code. Open the Epiphany web browser from the left end of Raspbian's Task Bar and go to netatalk.sourceforge.net. Under 'current releases' on the left, click the link to download the latest stable version (3.1.8 at the time of writing) in gzip format. It will be saved to your Downloads folder, and the Xarchiver app will open to show you its contents. Right-click the file within and choose Extract (if right-clicking doesn't work with your mouse, select the file, then choose Action > Extract). Put it in your Downloads folder (it should already be chosen for you).

We need to install the packages

listed at bit.ly/mfntpackages.

If you're new to this, it's safest to install one at a time. For each of the required packages, type `sudo apt-get --assume-yes install` followed by a space, type the name of a package, then press Enter.

Enter `cd ~/Downloads/netatalk-3.1.8`. To configure Netatalk's installer, enter the following text – every double hyphen should be preceded by a space, and every line below that ends with a hyphen has no space after it.

```
./configure --with-init-
style=debian-systemd
--without-libevent --without-
tdb --with-cracklib --enable-
krbV-uam --with-pam-confdir=/
etc/pam.d --with-dbus-
sysconf-dir=/etc/dbus-1/
system.d --with-tracker-
pkgconfig-version=1.0
```

You'll see a summary when this process completes. The next few commands each take a while to complete. Enter `sudo make`. When it's done, enter `sudo make install` to run the installer. When this finishes, verify Netatalk installed correctly by entering `afpd -v`. The first line of the response will be 'afpd 3.1.8 - Apple Filing Protocol (AFP) daemon of Netatalk'.

To start the software, enter `sudo service avahi-daemon start`, followed by `sudo service netatalk start`. These shouldn't return any output, but you should see 'raspberrypi' appear under Shared in Finder's sidebar on your Mac.

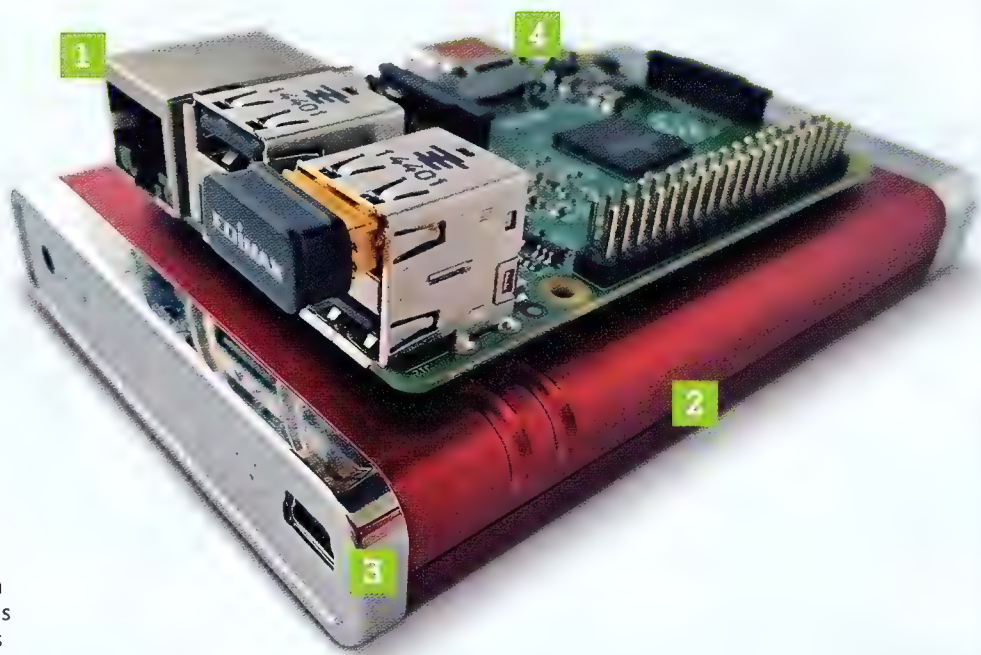
Explained... The hardware you'll need

1 NETWORK
We're using the Pi's Ethernet port, but you can use a Wi-Fi dongle to network your Time Capsule.

2 STORAGE
You can use any USB drive; we'd advise at least 2GB, depending on your Mac's drive.

3 USB PORTS
The Pi 2 has four, so you can connect storage as well as input devices. You may need a hub on other models.

4 RASPBERRY PI
The Pi runs Raspbian on an ARM processor. Raspbian is based on Linux, which makes Pi's official OS free.



You'll want Netatalk to start at login. Enter `sudo nano ~/.bashrc` and add the same two commands you just ran on new lines at the end of the file. Press Ctrl-O and then Enter to save the file, then Ctrl-X to quit Nano.

MAKE IT VISIBLE TO TIME MACHINE

Enter `sudo nano /etc/nsswitch.conf` and look for the line starting 'hosts: files mdns4_minimal'. Add a space to its end, then append `mdns4`. Save changes and quit Nano.

Now enter `sudo nano /etc/avahi/services/afpd.service` and enter this:

```
<?xml version="1.0"
```

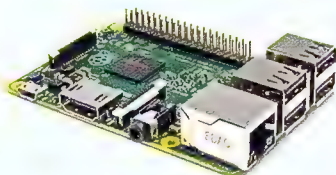
```
standalone='no'?><
!--*-nxml-*-->
<!DOCTYPE service-group
SYSTEM "avahi-service.dtd">
<service-group>
  <name replace-
wildcards="yes">%h</name>
  <service>
    <type>_afpovertcp._
tcp</type>
    <port>548</port>
  </service>
  <service>
    <type>_device-info._
tcp</type>
    <port>0</port>
    <txt-
record>model=TimeCapsule</
txt-record>
```

```
</service>
</service-group>
```

Save and quit, then enter `sudo nano /usr/local/etc/afp.conf` and under [Global] add `mimic model = TimeCapsule6.100`. Also, append this to the end of the file:

```
[[Time Machine 3TB]]
path = /media/time_machine
time machine = yes
```

Save and quit, then restart your Pi. In Finder on your Mac, under Shared in the sidebar, connect to the Time Machine partition on the Pi using `pi` and `raspberrypi` as the username and password, respectively. Finally, connect Time Machine to your Pi.



Best buys!

Our Time Capsule project is based on inexpensive hardware. Your Time Capsule will need a USB hard drive and a mains adaptor, of course. In addition to that, here's what we recommend.

Raspberry Pi 2
You can use any model of Raspberry Pi to create a Time Capsule. However, the Pi 2 has four USB ports, which makes life a lot easier.

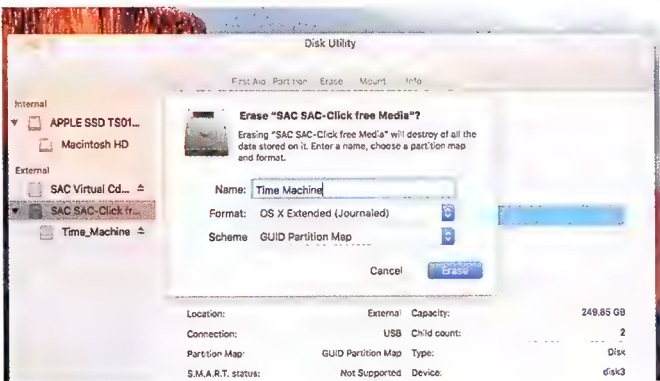


MicroSD card
You'll need to install the Raspbian OS on a MicroSD card. An 8GB one will do, but 16GB is more versatile and will cost you about \$20.

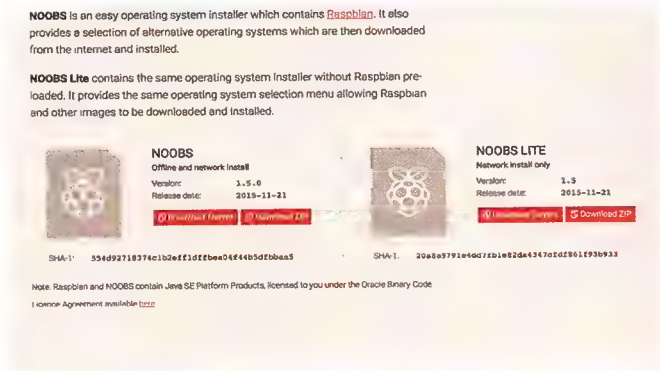


Raspberry Pi official case
The official case is modular, and its sides can be removed to gain access to the board's ports and pins.

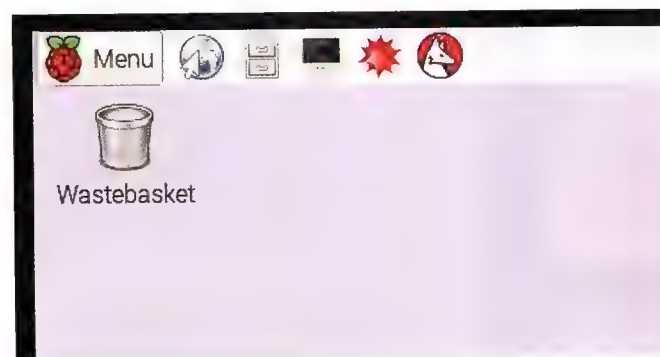
How to Prepare your hardware



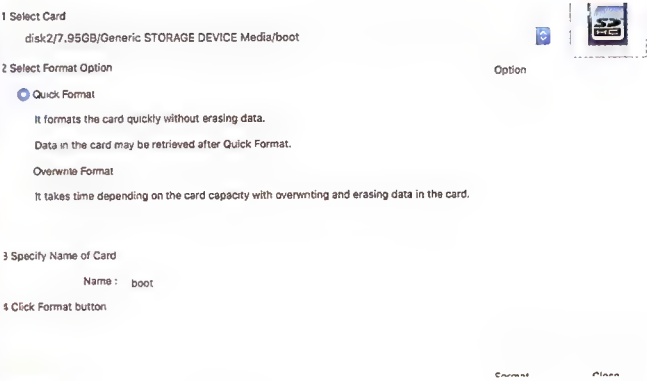
1 FORMAT THE HARD DRIVE
In Disk Utility, select the external volume, click Erase, name it 'Time Machine', select 'OS X Extended (Journaled)' and GUID. Click Erase. In Terminal, enter `sudo chmod 777 /Volumes/Time\ Machine && ls -l /Volumes`. The row for formatted volume must start drwxrwxrwx.



2 INSTALL NOOBS
Download the offline version of NOOBS in ZIP format from bit.ly/getnoobs. Unpack and copy the contents to your SD card. When you start up your Pi in a moment, you'll need to follow on-screen instructions for NOOBS to put a working installation of Raspbian on the card.



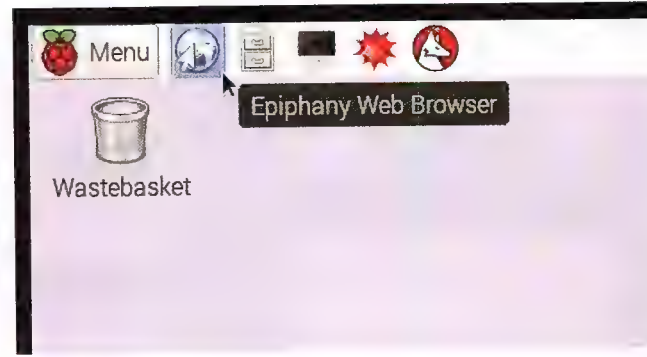
3 CONNECT TO YOUR NETWORK
When you reach Raspbian's desktop, ensure your Pi is connected to your network. Put the pointer over the icon of two networked computers at the right end of the Task Bar and a tooltip should appear with a line like 'eth0: connected' followed by an IP address.



4 FORMAT THE SD CARD
Download and open SD Formatter 4.0 from bit.ly/1T4Ufgs. Connect an 8GB or larger MicroSD card to your Mac and select it in the app's 'Select Card' pop-up menu. Next, select 'Overwrite Format' and enter `boot` (without quotes) in the Name field, then click Format.



5 ASSEMBLE THE HARDWARE
Eject the hard drive and SD card from your Mac and connect them to the Pi. Also connect a USB keyboard and mouse, an HDMI cable and a display, and connect the power supply. Using NOOBS to install Raspbian is simple, though a full guide is at bit.ly/runnoobs.



6 CONNECT TO THE INTERNET
On top of Raspbian, you'll need to download some additional software from the internet. Open the Epiphany web browser, which you'll find at the left end of the Task Bar, and direct it to a website to ensure your Pi can reach the outside world.

Android N: what you need to know

Google is prepping its next big Android release. Darren Yates takes a look at the new features and investigates which devices are likely to see an update.

With take-up of Marshmallow/Android 6.0 now having reached 7.5% of all Android devices as of early May 2016 (developer.android.com/about/dashboards), Google is well on the way to launching its next release, dubbed 'N' and due to arrive some time in Q3 this year. The search giant is on a four-to-six week beta release schedule, with final features (the application programming interfaces or APIs) likely nailed down by July.

Android 7.0 (if Google ends up calling it that) is shaping up to be one of the more significant releases. While we can't be certain about the complete features mix until final confirmation for Preview 4, Google has already outlined a decent shopping list of features in the meantime we wouldn't mind seeing.



MULTI-WINDOW SUPPORT

The big-ticket item in Android N gaining plenty of attention is the new multi-window support that allows you to have two apps open on the screen at the same time. Phone and tablet users can have the two apps open above-and-below in portrait mode, or side-by-side in landscape mode. There'll also be a resizing divider between the two you can drag to change their respective

sizes. The Recents button icon (the one on the right) will also split in two, indicating multi-windowing is in operation.

In addition, larger tablets will be able to offer a 'freeform' mode, which lets users resize apps in any form. But according to Google, this needs to be enabled by the device manufacturer, so it's unlikely to be universally available.

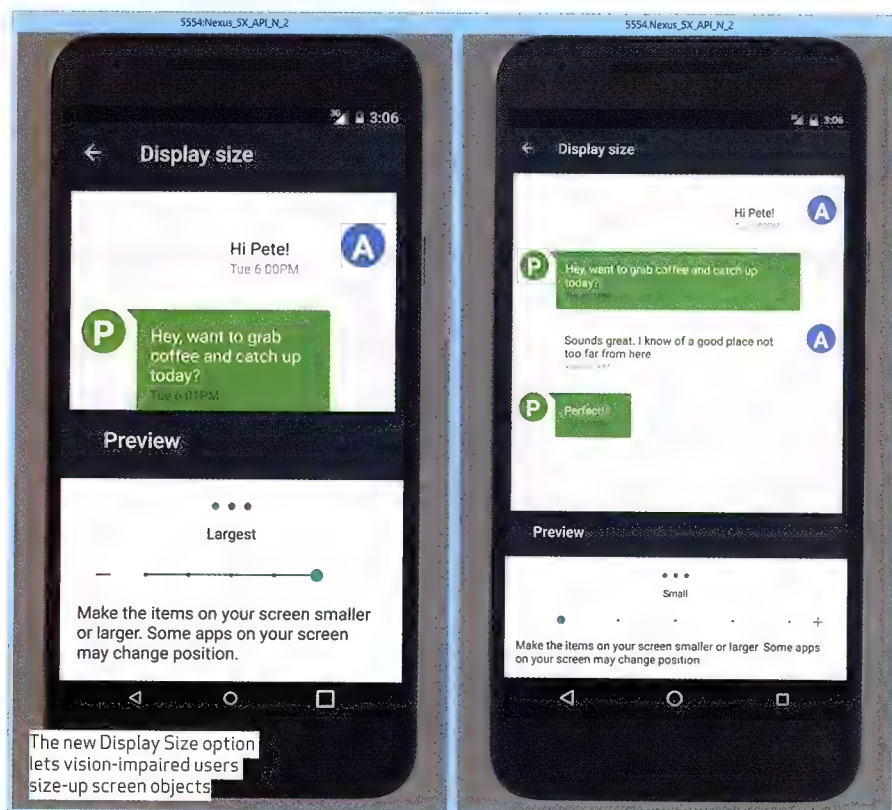
Android TVs will also get an equivalent through a new picture-in-picture mode. Essentially, you'll be able to view a video stream in the corner of the screen, while doing whatever on the remainder. Think of it as kind of similar to Android's YouTube app corner video-screen feature.

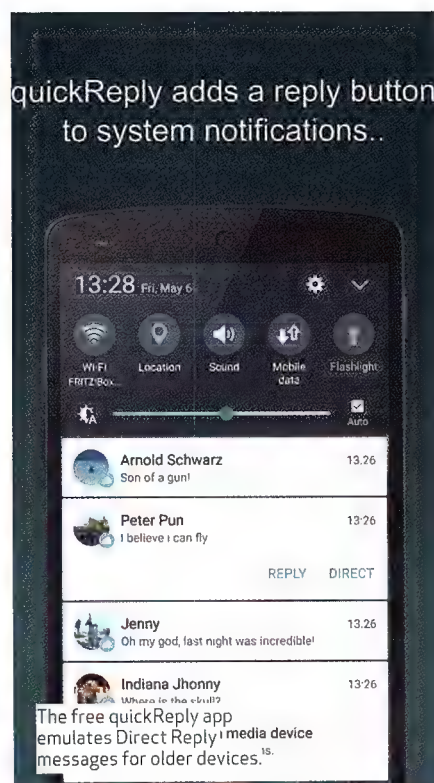
App developers will be able to set the minimum dimensions of the app activity (the app window) that users can't resize below, but users will also gain the option to drag-and-drop content between apps that currently share the screen.

Those with vision impairment should benefit from a new 'Display Size' option, allowing you to zoom aspects of the screen, increasing the size of content and making it easier to see. You should find it under Settings > Display > Display size.

NEW NOTIFICATION OPTIONS

Android's notification alerts are really useful, but it doesn't take much for your screen to be crawling with the blighters. One new feature in Android N to combat this is bundled notifications. It's an idea lifted from Android Wear that allows the system to bundle together in groups messages originating from the same apps, which





the user can then expand and handle one-at-a-time as before.

Another new feature is 'direct reply'. Rather than having to launch the SMS app to respond to a message, Android N offers a new in-line reply option that runs inside the notification interface itself. And it's not just Google apps that can avail themselves of this new option – Android includes the API commands enabling in-line replies, meaning app developers can begin implementing it.

Have at least Android Lollipop/5.0 on your device? You can reportedly achieve Direct Reply-like functionality right now through an app called 'quickReply' on Google Play (tinyurl.com/zzhpfhl). At time of writing, it had a 4.0 rating.

DATA SAVER

If you've ever been stung by excess data charges, Android N's new Data Saver feature could prove to be a real boon. It'll be a new option within the Settings menu that puts up a wall against background data usage as well as notifying all apps to reel in foreground data usage. You'll still be able to allow specific apps to have full access to data (whitelisting) if you wish.

The downside is that, beyond the OS-level background block, apps will likely require an update to support the app notification. As Google's Android Developer page on Data Saver puts it: 'It is considered good practice for apps to check whether the user has enabled Data Saver and make an effort to limit foreground and background data usage' (tinyurl.com/zecvmp9).

Just how much 'effort' apps are expected to go to in limiting foreground data in Data Saver mode is unclear, but 'play nice' appears the overriding message.

PROJECT SVELTE

With plenty of focus in the two previous revisions, power management receives less attention this time around, but still gains some efficiency tweaks. Doze, the power management subsystem that reduces system and network activity when the phone is left alone with the screen powered down, gets new refinements that cover when the device might be on stand-by but moving, as in when you're carrying it around with you.

More subtle changes come in the form of the on-going 'Project Svelte', Android's RAM minimisation effort, which, this time around, includes removing three 'implicit' command broadcasts. Broadcasts in Android are messages sent by background code that can be received by any app that subscribes to them (think Pay TV), triggering those apps to launch or perform some action. The problem is, some broadcasts have too many subscribers – Google gives the example of the 'CONNECTIVITY ACTION' broadcast, to which, apps subscribe to learn of any changes in network connectivity. If a network connection changes, this causes the broadcast to fire, waking up every app subscribing to it, all demanding action at the same time. This can pull down on battery power, but also increase the demand on

quickReply adds a reply button to system notifications..

CPU and memory (tinyurl.com/gpdx6qn). So, it's gone in Android N, replaced by the preferred JobScheduler process.

ANDROID TV RECORDING

Google is looking to further make use of the processing horsepower available in Android TVs by expanding their 'time-shift live TV' capabilities to include recording TV to storage. At time of writing, Google warned developers might have trouble testing this since Android TV's current Live Channels app doesn't yet have the controls to set recording or playback. It seems, for now, the capability is limited to API commands, although this should change before long. The new functionality will allow users to choose what is recorded, when and where, as well as provide a manager for playing back recordings (tinyurl.com/h6m46hr).

NETWORK SECURITY CHANGES

Android often seems to be fighting off claims of security issues, so it's not a surprise security gets further improvements in this latest revision. Amongst the more significant features is new network security configuration. Rather than having to configure an app's network security settings within app code, Android N will allow apps to set up these options using standard XML configuration files. These are then plugged into the App's 'Android Manifest' file.

Among the new options are the ability to set custom certificate

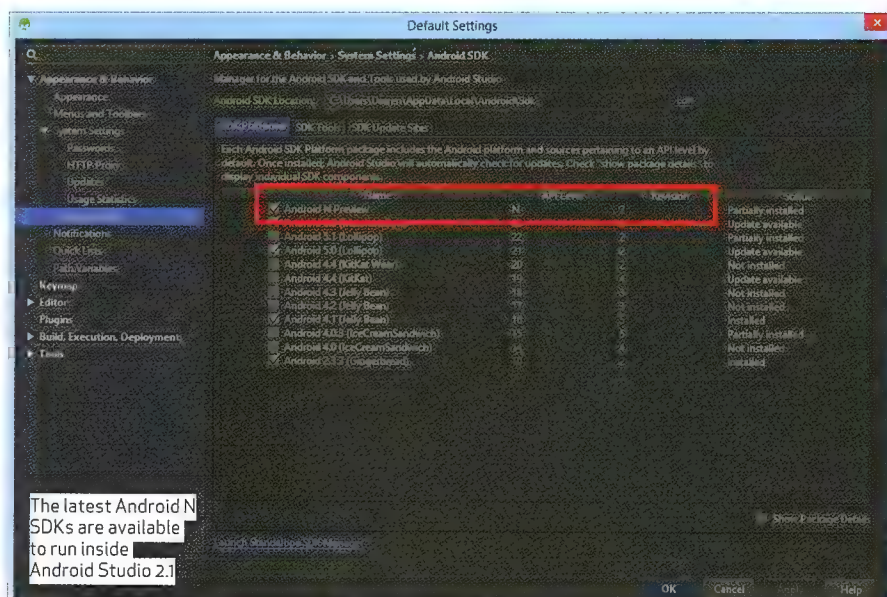
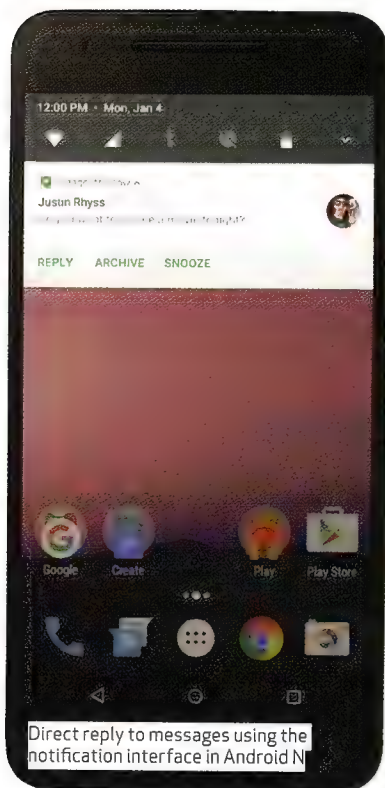
authorities (CAs) as well as block the use of plain-text traffic. If an app is designed to use an encrypted connection (HTTPS) to a website, the 'opt out' setting here stops any accidental transmission of plain or 'clear' text (tinyurl.com/zoscrsk).

JAVA 8 SUPPORT

Android N will be the first Android release to support the newest features in version 8 of the Java programming language, including default and static interface methods and repeatable annotations. However, developers will need to install the latest Android Studio 2.1 IDE, in addition to the Android N Software Development Kit (SDK), in order to build N-compliant apps.

Google says even if you're happy to stick with Java 7 code, you'll still need to compile your apps against the Java 8 Development Kit (JDK) for them to work on Android N. You'll also need to implement the new Jack toolchain (a toolchain is a set of tools that work in series converting code from source into executable form). You'll find details on the Gradle build changes required to implement Java 8/Jack on its preview page (tinyurl.com/gmhwqdv).

Another more subtle change under the bonnet affects the Java libraries Android uses. It's a long story, but a legal battle between Google and Oracle, gatekeepers of the Java language, over Android's use of certain Java libraries is being suggested as a reason behind a switch to open-source OpenJDK



libraries (tinyurl.com/gonpmk3). However, the switch is also the main reason new Java 8 features become available in Android N — so while it's a likely win for Google, it's also a win for app developers, too.

PROFILE-LED COMPILATION

When Google launched KitKat/Android 4.4, it spunked the advantages of its new Android Run Time (ART) app execution engine, through the benefits of ahead-of-time (AOT) compilation. ART replaced Dalvik, Android's initial run-time engine, changing the way Android apps were built. Instead of compiling the bits of the app it needed just before it needed them ('just in time' or JIT), ART compiled everything in the app up-front. This took up more space and required more RAM, but given Android devices at the time were cranking up both, and fast, it wasn't really a problem. The overall benefit was faster and more efficient code operation.

But interestingly with Android N, Google is bringing back a JIT compiler into ART to work in conjunction with the AOT compiler and will be profile-driven. The idea is ART will decide

which bits of an app are compiled ahead-of-time and which bits can be left un-compiled until needed. Google claims it'll be a feature important for 'low-memory devices'.

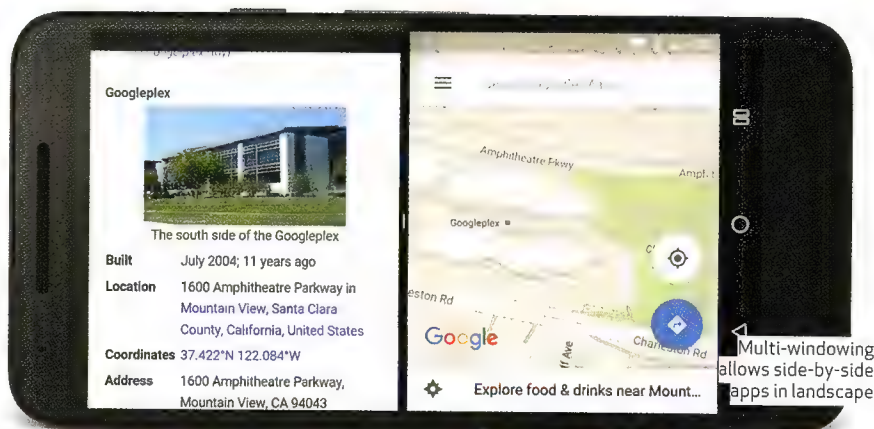
NO 3D TOUCH?

One of the features Apple promoted on the release of the latest iPhone 6s-series was 3D Touch, a pressure-sensitive action that allows control of app functions by how hard the user presses the screen. Google hasn't confirmed or denied anything as of time of writing, but reports suggest that 3D Touch won't arrive in the initial release of Android N, but is likely to appear as an update after launch.

For 3D Touch to work, you need a device with a pressure-sensitive screen. Market analysts IHS predicted at the end of 2015 that a quarter of all phones arriving this year will have that tech (tinyurl.com/ht4lu8o). Plenty of bright rumours expected the Galaxy S7 Edge would feature a pressure-sensitive display panel, which wasn't the case.

WILL MY DEVICE GET AN UPDATE?

If we had a dollar for every time we've





Android TVs will receive new picture-in-picture functionality.

heard this question over the last five years! When it comes to Android updates, you never say 'never' in this game, but there are some pretty reliable rules-of-thumb that come into play here — if your Android device is less than 12 months old, the chances are pretty good, you'll get an 'N' update. If it's between 12 months and two years, the chances are less good, but still probably better than even-money. However, if your device is more than two years old, it's highly unlikely you'll see an 'N' update — officially, at least.

WHAT ABOUT CUSTOM ROMS?

Custom or community-based ROMs are a completely different story. You'll probably start seeing unofficial ROMs appear for certain phones not long after Google releases the Android Open Source Project (AOSP) version of Android N. ROM developers will need to work out device driver software for various phone models, incorporate those into the new ROMs, test them and then make them available. Popular phones, particularly those with unlocked bootloaders, will likely be first as well as most numerous supplied with ROM options. (Personally, I'm hoping Samsung's Galaxy S3 extends its streak of support with another run.)

But custom ROMs aren't just for devices abandoned by their makers. They're also for those who want less bloatware and more control over more recent devices.

WHAT TO WATCH OUT FOR

Just be aware that with custom ROMs, they're likely to have some features that do not work — at least for the

```
<?xml version="1.0" encoding="utf-8"?>
<manifest ... >
  <application ... >
    <meta-data android:name="android.security.net.config"
               android:resource="@xml/network_security_config" />
    ...
  </application>
</manifest>
```

New network security configuration files can be added to the app manifest

initial or early 'alpha' releases. Again, this depends on the skill and dedication of the team behind the ROM as much as the availability of device driver software for the various hardware features within the phone. If you're tempted to try a custom ROM, make sure you know what works and what doesn't — there's no guarantee things that don't work will ever get fixed, particularly if you're using a lesser-known ROM on a less-than-popular device. And we can't stress this enough, if a ROM isn't designed for your specific device model, don't go near it. Run. Just run.

GETTING IT NOW

If you can't wait, Google is making Developer Previews of Android N available for its latest flagship smartphones, the Nexus 6P and 5X, but it's also surprised more than a few with a preview available for Sony's Xperia Z3 (tinyurl.com/jfuex4b).

Bottom line, however, we'll have to wait for Preview 4 before we know with certainty just which features make it into Android N. Still, this list isn't a bad start. ■



Make a virtual Arduino

Want to try out Arduino for free? Autodesk's free 123D Circuits simulator lets you build Arduino circuits with your web browser. Darren Yates explains how.

When I was a kid, I was given one of those 150-in-one electronic kits and loved it. The manual came with 150 different circuits to build by just following the wiring numbers, pulling the springs to one side and poking the supplied pre-cut tinned wires into place.

Today, the kits are (almost) gone, but if you're interested in trying out Arduino yet not too confident with hardware, there's an interesting 'soft' option, using a free Arduino simulator from computer-aided design (CAD) software maker Autodesk.

HOW IT WORKS

Autodesk's 123D Circuits is a browser-based electronics circuit simulator with a focus on Arduino. Just head to <https://123d.circuits.io>, sign up for a free account and you can begin creating your own virtual Arduino projects.

To start building a new project, click the '+ New' button at the top-right of screen to reveal the pop-out command menu down the right-hand side and select 'New Electronics Lab' from the menu list. It'll take a few seconds, but you'll soon be presented with a blank breadboard, ready for you to start building.

ADDING COMPONENTS

You'll find components by clicking the '+ Components' button on the new menu row at top right of the page, which opens up a grid of available components at the bottom of the screen. Just scroll through and click on the box containing the component you want, move your mouse up to the breadboard and the component will follow the cursor. Locate the breadboard position you want and left-click to drop the component into place. Need to rotate a component? Click on it to highlight it and click the rotate button on the top-left command row until the component is in the position you need.

Among the components, you'll find a number of Arduino options, including the Uno R3 we've used extensively in this masterclass series, along with the breadboard-favourite Arduino Micro.

There's even some basic-function test equipment available including a

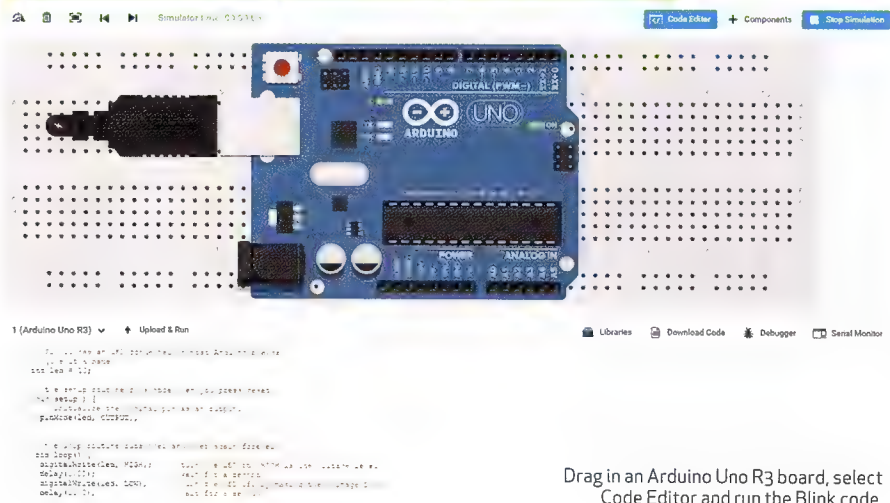


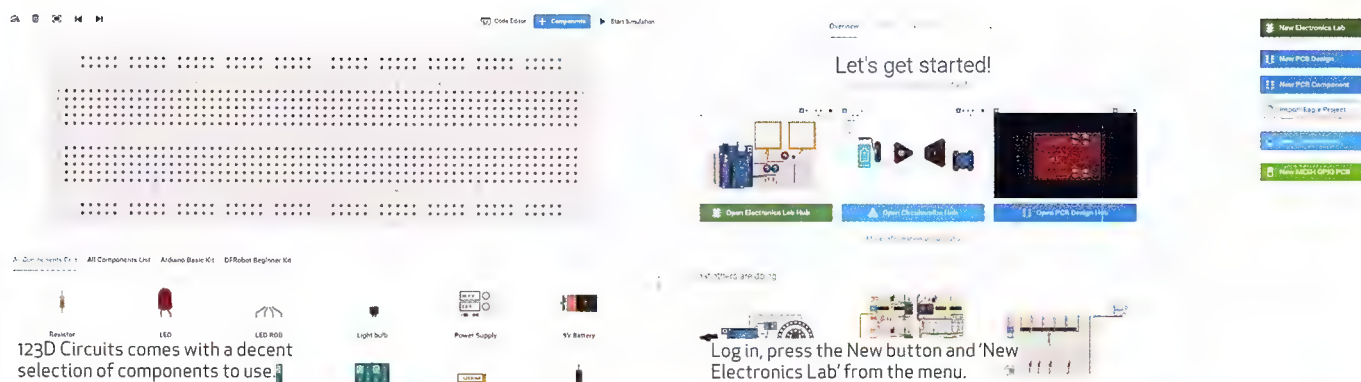
A hub for every goal.

digital multimeter plus a simple oscilloscope that you can add to your circuit for diagnostics. These are great as introductory tools – the multimeter can measure voltage and current, while the oscilloscope, or 'CRO' (cathode-ray oscilloscope) as old-hands will know it, allows you to 'see' the voltage waveforms at the point you connect up the CRO to your circuit.

Your project begins with a clean-slate 840-point breadboard.

"As with building real circuits, you do need to be careful with component choices – for example, select a current-limiting resistor too low in value connected to an LED and you'll 'virtually' blow up the LED."





These are very basic components however, with the CRO offering only a single trace and a single time-base control, which sets the length of time covered by each grid square on the screen. Actual multimeters and oscilloscopes have many more controls and options.

One quick tip - when adding components such as resistors and capacitors, you add the basic component and set the value you desire in the blue edit window on the top-right.

ADDING WIRES

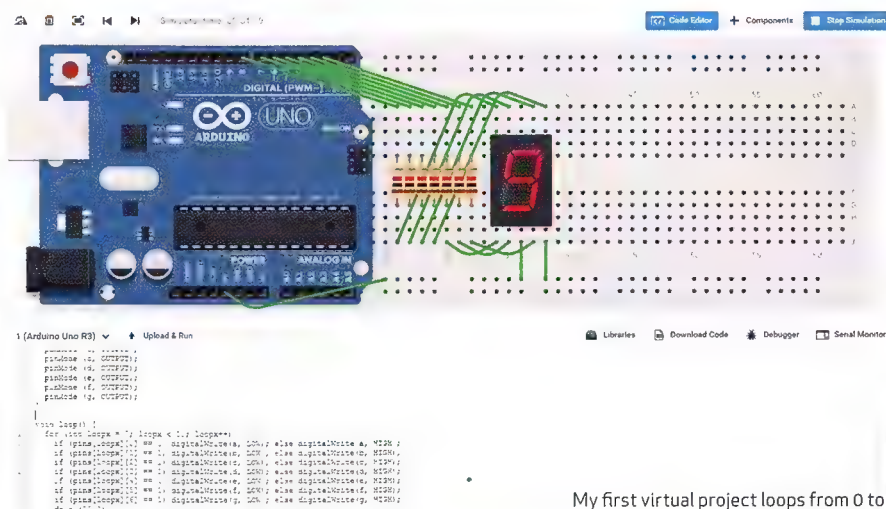
To join components together, you need to add connecting wires. This is quite easy - just move your cursor to the start point until you get a red square under your cursor. Left-click, move your cursor to the wire finish point you want and left-click again. Use the blue item box at the top-right to change the colour from the default green if you wish (using multiple wire colours can make identification easier, particularly if you have lots of wires in a small space).

WRITING CODE

Just like the real thing, the virtual Arduino devices require you to write genuine Arduino code and you do this by firing up the Code Editor, available by tapping the command button on the top-right of the window. You must select and drop an Arduino device into your project before you can begin programming it, but the code editor isn't too dissimilar from the basic Arduino IDE.

To begin with, bring the Arduino Uno R3 onto the breadboard, launch the code editor and it will automatically load the example 'blink' code. All you need to do is click the 'Upload & Run' button and the simulator does the rest - the LED next to the Arduino infinity logo will begin flashing once per second.

When coding your project, remember the Arduino code basics - the 'setup()' method runs once at the start and the 'loop()' method loops continuously thereafter until you either reset the device or stop the simulation. You can also include your own methods.



My first virtual project loops from 0 to 9 on a seven-segment display.

TRY IT YOURSELF

To test it out, I made a simple seven-segment display project called 'Counting up'. You'll find it at <https://123d.circuits.io/circuits/2111247-counting-up>. It uses a standard seven-segment display wired to an Arduino Uno R3 and counts up digits '0' through '9' on a continuous loop. The Arduino code replicator seems quite decent - at least good enough to support multi-dimension arrays that were used in this project.

As with building real circuits, you do need to be careful with component choices - for example, select a current-limiting resistor too low in value connected to an LED and you'll 'virtually' blow up the LED. Unlike in real-life, there's no 'give' in the nominal maximum current tolerances - go beyond the set limit and you get instant destruction. But at least it doesn't cost you a real component - just change the values and run the code again.

What's also good about 123D Circuits is it's not just for Arduino - it has a reasonable list of 74HC High-Speed CMOS logic chips and other components for building 'discrete' electronic circuits. You can also interact these chips with an Arduino to build whatever your imagination dreams up.

IMPROVEMENTS

For what it does and the fact you can do it in a web browser, 123D Circuits is a great learning tool for genuine newbies who'd be otherwise dangerous with a soldering iron in-hand. For students who've never seen electronic components before, it's a solid introduction, but one, we think, you might eventually outgrow. The list of component options isn't exhaustive by any means and little things like labelling whether the seven-segment display is common-anode or -cathode (its common-anode) would help.

BUILDING ALWAYS BETTER

Ultimately, entry-level circuit simulators have their place, for sure, but they can't replicate the learning you gain when you build with actual real electronic components. The practical aspects of electronic design, particularly analog electronics, are difficult to simulate with perfect accuracy, but overall, 123D Circuits does a passable job.

Plugging wires into a 150-in-1 electronics kit might seem antiquated, but the lessons I began learning as a kid building real circuits are just as important today. ■

Write your own benchmark apps

Benchmarking is a key part of any technology evaluation. Darren Yates explains how to write your own test apps.

Many of you may remember 'PC User' magazine, the predecessor of our sister publication, TechLife. Back in 2005, PC User, like many other publications, was using benchmark apps from a major US publisher to carry out product reviews, when we received word those apps would no longer be developed. That left us in a bit of a pickle. However, it also provided an opportunity. Instead of looking for another benchmark suite filled with other people's ideas of what makes a decent test, I figured why not use the then-ten years' experience I'd built up reviewing PC products and develop a benchmark suite that fits our readers' needs?

A couple of months later, the first of PC User's UserBench benchmark tests was born and we began using it in the magazine. Development continued and new releases were produced for another seven years. To our knowledge, UserBench was the first PC benchmark suite developed in Australia.

You don't necessarily need to be a professional programmer to find opportunities to put your skills into practice in your workplace or business. Understanding the problem and what is needed (broadly called 'Systems Analysis'), along with building the solution ('Systems Design') are skills you may be able to grow through understanding your own job or career ('Domain Knowledge').

Play around with PC gear long enough and you'll eventually run into benchmark testing, either evaluating your own gear or reading the results of others. But learning how to build and run even the simplest performance tests is a skill that can go way beyond CPUs and motherboards.

PRECISION TIMING

Any software benchmark test is about repeatable testing of system performance. Essentially, you're looking to time how long it takes for a device to perform some given task, whether it's a game demo, processing video, Javascript, HTML or whatever,

```

---
244 void calculatePi() {
245     double pi = 0;
246     long progress = 0;
247     timeStartM = System.currentTimeMillis();
248     timeStartN = System.nanoTime();
249     for (int x = 1; x < iterations; x++) {
250         if (stop == 1) break;
251         double fraction = 1.0/Math.pow(x,2);
252         pi += fraction;
253         if (x % (iterations/100) == 0) {
254             progress = 1+x/(iterations/100);
255             jProgressBar1.setValue((int)progress);
256             jLabel7.setText((int)progress+"%");
257         }
258     }
259     pi = Math.pow(pi*6,0.5);
260     if (stop == 0) {
261         timeEndM = System.currentTimeMillis();
262         timeEndN = System.nanoTime();
263         timeRunM = timeEndM - timeStartM;
264         timeRunN = timeEndN - timeStartN;
265         jLabel4.setText(timeRunM+"ms");
266         jLabel6.setText(timeRunN/1000000.0+"ms");
267         jLabel9.setText("Ready.");
268         jLabel12.setText((int) (1265500.0/(timeRunN/1000000000))/1000.0+"");
269     }
270 }

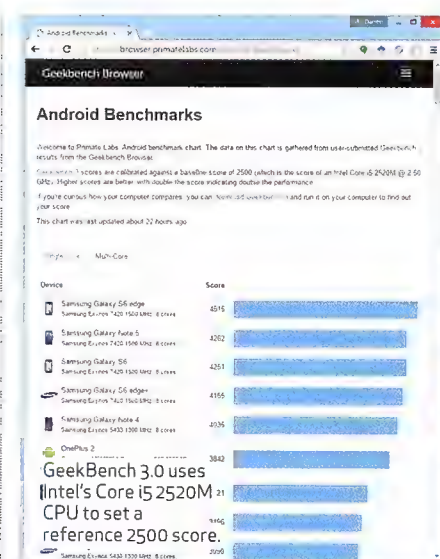
```

Our Simple Pi Benchmark's calculatePi() method runs in its own thread.

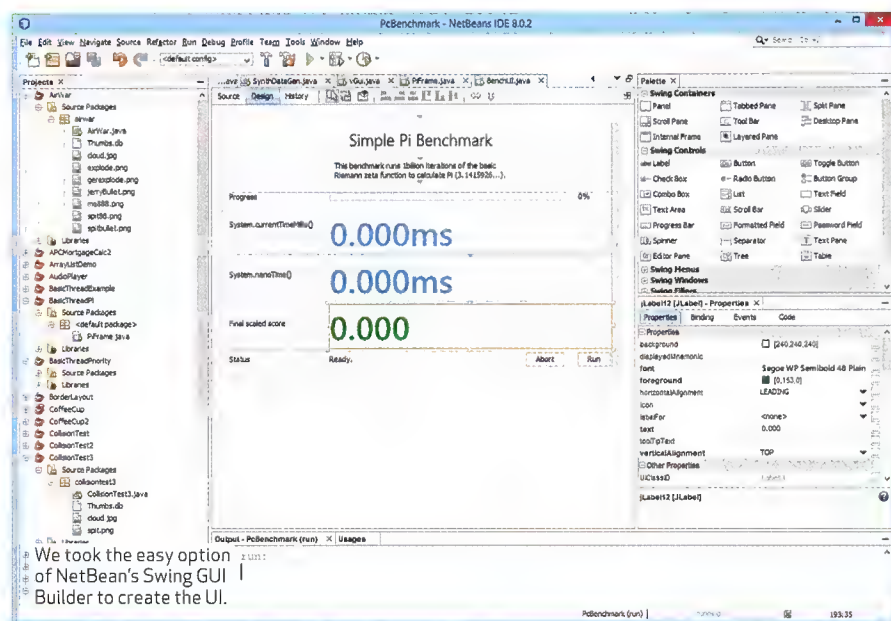
without having to resort to a stopwatch. That starts with understanding how to code precision timing. You want to be able to independently and automatically measure the time it takes for your benchmark process to complete. You can choose whatever app you like to form the basis of your benchmark process, but you want the timing precise and accurate.

Java has a number of different ways to measure time, depending on your application. For situations where sub-second resolution is required, the most common option is the `System.currentTimeMillis()` method (<http://tinyurl.com/hgwzypm>). It returns an unsigned 'long' 64-bit data object (eight-byte non-negative integer) containing the current millisecond count since the Unix epoch (12am on 1 January 1970).

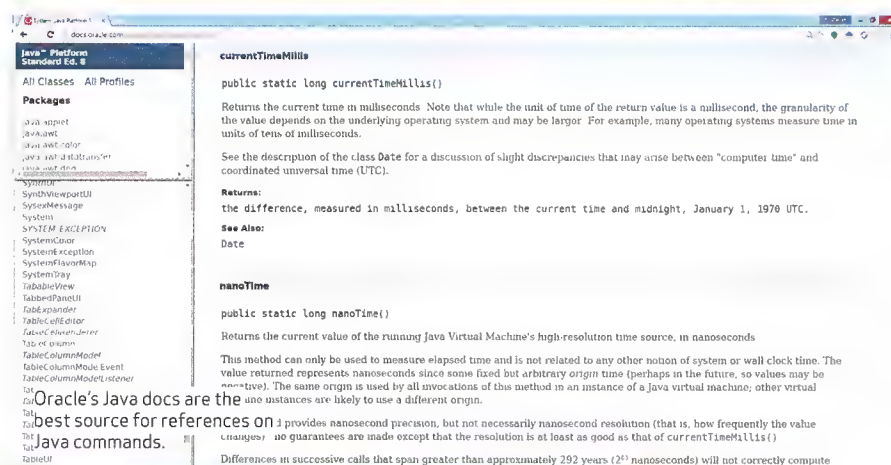
However, there's a very good argument that it's the wrong option for benchmarking. The reason is that `currentTimeMillis()` forms the basis of what's described as Java's 'time-of-day' clock, which is taken from the operating system. Since operating



system time is frequently adjusted for accuracy (no PC clock is perfect), the `currentTimeMillis()` value also gets adjusted, being Java's representation of absolute time. Furthermore, according to the Java docs, you can't guarantee the precision or 'granularity' of `currentTimeMillis()` will be better than 10-milliseconds, the common update

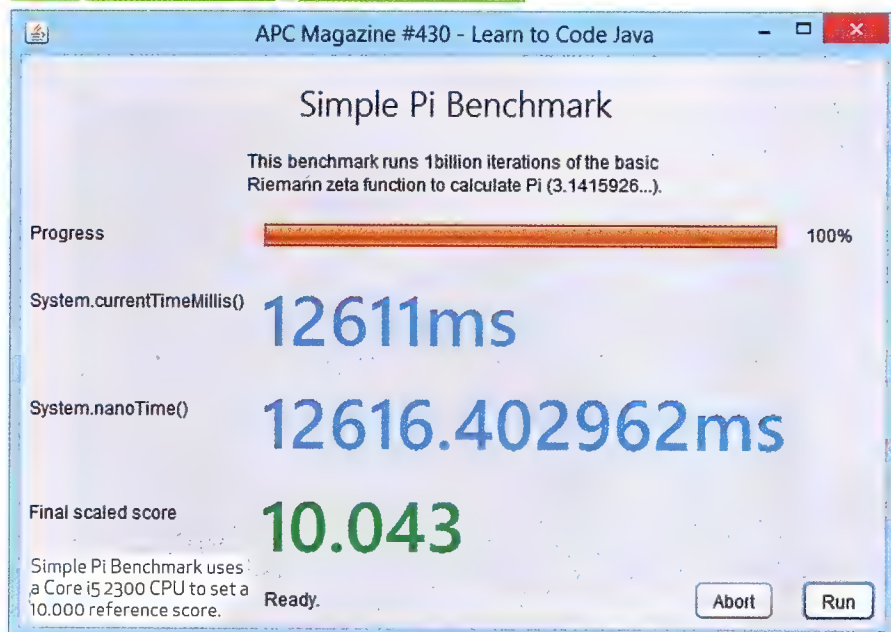


We took the easy option of NetBean's Swing GUI Builder to create the UI.



Oracle's Java docs are the best source for references on Java commands.

"If there's ever a golden rule in benchmark testing it's this – change only one thing at a time."



benchmark tests, decrying the 'speeds and feeds' concepts of reviews as a waste of time. Nonsense – the more information you know about a system, a process or a product, the more informed a decision you can make about whether to buy it, replace it or skip it.

If there's ever a golden rule in benchmark testing, it's this – change only one thing at a time. Normally, benchmark testing is all about trying to gain comparisons – how does one motherboard compare with another or one graphics card compare with another. If you're testing a new graphics card, you don't go changing the motherboard, the CPU and RAM at the same time unless it's unavoidable, for example, testing AMD versus Intel performance – and even then, you change as little as possible. If you're testing motherboards from the same class, you don't go changing the CPU, graphics card or RAM for the sake of it. You want any change registered in your 'before' and 'after' tests to be the result of the one item you're testing and that item only. Otherwise, how do you know which component caused the change?

We might be talking about PC components here, but as a programmer, you could be asked to test the run-time performance of an external system, say, the time for a share transaction to be sent from a share trading system and received by a share-processing server. Understanding how a system works, the parts of the system that vary and which parts of that system can be locked down can make a huge difference to the overall accuracy of your measurements.

KNOW WHAT YOU'RE TESTING

It's also equally important to understand what it is you're testing – the 'problem domain'. If you're testing a smartphone for browser Javascript performance, you don't necessarily want the device downloading your daily bitTorrents at the same time – unless you're specifically testing for that condition.

Understanding how different devices work is key. For example, in a PC, you want to shutdown all other apps – the only app running should be your benchmark test. But on a smartphone, the memory model is completely different, so rather than killing other apps, you want the phone in an app-stable state. You still don't want it downloading updates or anything else, but ensuring the device is in a 'steady state' is important, particularly for repeatability. Again, having this 'domain knowledge' makes a difference.

MULTIPLE TEST RUNS

For whatever reason, you are not going to get the exact same result every time you run a benchmark test – for example, system processes can pop up for unexplained reasons at different times. That means it can be dangerous to simply run a test once, grab your run-time result and be on your way. At a minimum, you should run tests three times. There are various options you can then choose from for creating the final result – average all three results; always take the slowest, fastest or middle result; or drop the one that's furthest away from the other two (the 'outlier') and average the remaining two.

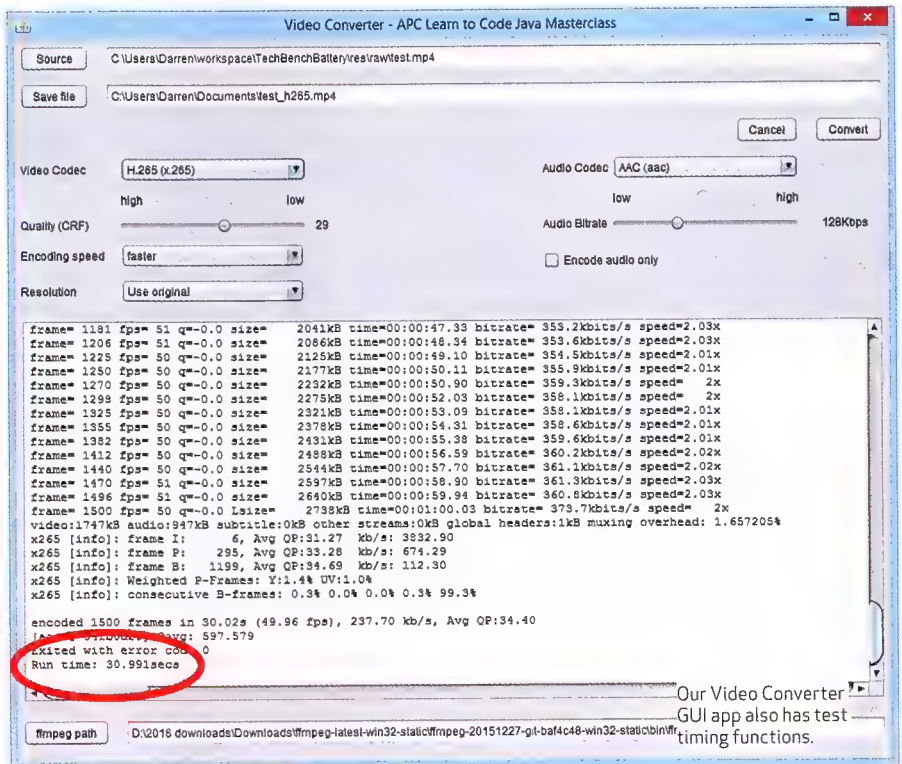
REFERENCE POINT

Having the raw run-time in milliseconds from your test runs is excellent, but in terms of telling the story of performance to another stakeholder, it may not necessarily help. As we've said, benchmark testing is almost always about comparison – whether it's comparing between two devices or products, or testing single devices and keeping a long-running on-going record. Unless you have multiple devices to test, comparing against a known reference can also give you an excellent starting point to discuss that performance.

A reference point is a known marker on which your benchmark has been tested and the result recorded. For example, UserBench Encode HD had a reference point set against a 2GHz Intel Pentium 4 desktop PC – yep, that's ancient history dug up from the sands of Egypt kind-of stuff today, but a well-enough-known PC standard nonetheless. We first ran the benchmark test against this system on multiple occasions and set the averaged run-time as a reference point of 10.000. That run-time then became the reference point on which new devices under-test were compared. If a PC scored 84.07 on UserBench Encode HD, for example, we knew immediately that system was 8.407-times faster than the 2GHz Pentium 4 reference on that test.

Here's how it works from a coding perspective: you run your test on your reference device and it takes, say, 30seconds to complete – this now becomes your base reference point, which you set as 10.000 and that 30seconds becomes the baseline scaler.

You can now run the test on a new device you're reviewing and say it takes 20seconds. Divide your 30-second reference by the new 20-second time and you get 1.5. That tells you the new device is 50% faster than the reference. But as we've set a base reference point of 10.000, we can multiply the result by 10 to give a score



of 15.000. Whatever you set your base reference score to is really up to you – we chose 10.000 for UserBench Encode HD because we wanted to differentiate it from the various benchmark sub-test component scores, which were referenced to 1.000. As another example, GeekBench 3.0 chose 2500.00 as their reference score against an Intel Core i5-2520M CPU.

If you now test a second device later without access to the first, it's not a problem. Say a new device gets a run-time result of 15seconds – we compare that against the base reference score and end up with a score of 20.000, meaning this new device is twice as fast as the reference. But we can also compare this new device with the previous one – dividing the 20-second runtime of the previous device by the 15-second time here gives us 1.333, meaning this new device is 33.3% faster than the previous unit.

BENCHMARK EXAMPLE

To bring this all together, I've coded up a very simple little benchmark app called 'Simple Pi Benchmark'. It takes the Riemann zeta function and runs it through one billion iterations. Those iterations are timed using both `System.currentTimeMillis()` and `System.nanoTime()` to show the differences these two timing methods can give in practice. The benchmark runs the Riemann zeta function in a separate thread and can be aborted at any time.

On my ageing 3.2GHz Intel Core i5 2300 desktop PC, the test finishes in (more or less) 12.655seconds – we've set

that as the reference score of 10.000. If you run the test on your system and get a final score of 20, your system is twice as fast as mine.

GETTING THE SOURCE CODE

You'll find the Simple Pi Benchmark source project files on our website at <http://apcmag.com/magstuff>. If you haven't already, download and install the NetBeans IDE and Java SE Software Development Kit (SDK) bundle from Oracle's website (<http://tinyurl.com/apc429-bundle>). Next, grab the downloaded source file and unzip the outer file only, launch NetBeans, select File, Import Project, From ZIP and choose inner 'PcBenchmark' zip file. Run it. If you've been following this series for a while, the code should be fairly easy to understand.

ALL ABOUT COMPARISONS

Performing a benchmark test in isolation isn't going to tell you much. Almost always, you want to compare the results with another device or product to better understand the two. Particularly in PC hardware, having a known reference point provides some perspective that raw scores may not, allowing you to more quickly gauge comparative performance. The same thing goes for whatever you're testing – starting with and comparing against a known reference can make it easier to explain performance differences.

It's a system that's easy to implement in code and has served me well for years. ■

downtime

» NAMES: EDITED BY TROY COLEMAN

The Emperor's horse can be upgraded to a pegasus, then a griffon

"The end times came and I ignored them, pretending it wasn't my problem until it was too late"

apc
HOT PRODUCT

\$89.95 | PC | WARHAMMER.TOTALWAR.COM

Total War: Warhammer

Bludgeons two very different games together to make a beautiful monster.

Dwarfs line the walls of the Everpeak, weapons ready. They fire bolt and lead at the incoming Orcs, but to the giant lummoxing forward at the head of the green horde, it may as well be a light smither of rain. The giant crashes into the gates, stumbles back and crashes into them again. It bursts through only to be faced by massed units of Longbeards: fearless Dwarf veterans who mob it like dogs harassing an elephant.

They win, because in the rock, paper, scissors of *Total War: Warhammer*, the Longbeards' immunity to psychological effects makes them good at fighting fear-causing giants. Slayers would be even better, as they have the Anti-Large trait as well as Unbreakable, but this is a game where paper can beat scissors so long as there's enough of it.

Total War is a turn-based strategy wargame that erupts into real-time, cast-of-thousands battles whenever armies meet. Until now, the series has recreated historical eras, and so the tactics made available in combat have always been based on simplified versions

of real-world approaches, whether deployed by Rome or Napoleon. Cavalry units flank, and race ahead to attack missile units before they get too many shots off; spears defend and resist cavalry charges; missile units pour volleys into dense infantry units as they slowly advance. Not any more.

GEEK MYTHOLOGY

While there's plenty of crossover between fans of historical wargames and Warhammer, as shown by the way two of the previous *Total Wars* received fan-made mods that squeezed Warhammer armies into them. This is something else. This is a ground-up reinvention of the *Total War* formula to make it suit the fantasy setting of the Old World. In previous *Total War* games the different factions all played in a relatively similar way to each other, but not here.

The Greenskins, for instance, have a meter measuring each army's Fightiness. Win battles, and it rises. Lose, or squat in your hovels like a coward, and it drops. If Fightiness is high enough, and there are at least 17 out of a maximum

20 units in the stack, all that victory encourages other Orcs to band together in a bonus force called a Waaagh! For other species, buying and maintaining multiple armies is a huge expense, but Greenskins can earn them free, which encourages a state of constant aggression that's entirely appropriate.

Dwarfs on the other hand have to keep track of grudges. They never forget a slight, carefully noting each in a massive book of bitterness. Any time their land is raided or attacked or Dwarfs are hindered in any way, some scholar back at the capital sucks in air over his teeth and says, "That's going in the book." While revenge earns rewards, having too many unavenged grudges drops public order as people lose faith in their leader. It breeds a playstyle all about defence, limiting fronts on which the Dwarfs can be attacked and only marching off to make new enemies when old ones have been thoroughly dealt with.

Meanwhile, the Vampire Counts rely on spreading corruption in the form of a grey, sickly taint on the map. Other factions suffer attrition when moving

across corrupted land while Vampire Counts armies are diminished by marching across uncorrupted land. The Vampire Counts can also raise the dead to fill armies instantly rather than waiting.

The final of the four playable factions is The Empire. Modelled on the Holy Roman Empire, the humans are the most traditional faction, their starting units including crossbowmen, spearmen, and knights who will be more familiar to *Total War* players than terrorghists and arachnaroks. Imperials get weirder as they go on, boasting steam tanks and knights who trade horses for eagle-headed demigryphs, while their leader Karl Franz can upgrade to a flying griffon.

FIGHTING FANTASY

There's variance between factions in both the turn-based campaign game and the real-time battles. Dwarfs don't have wizards but are blessed with plenty of artillery, and are generally more of a defensive, come-get-me-you-lanky-bastards force. Vampire Counts don't have missile units so for them it's all about lurching forward, targeting specific enemies with flying units and Black Knights while the



The tactical map gives a good overview of how you're losing



Imperial nobles can be given fancy titles to keep



Chaos Marauders, about to maraud



Leaping, or caught by a low-flying terrorgeist?



Dwarves are basically ageing, embittered bikers

skeletons and zombies shamble up to fill the gaps. The Greenskins have a bit of everything, but can be hard to control. When their Leadership drops due to being flanked or attacked by enemies who cause fear, they have a tendency to scarper, but recover quickly and need to be shepherded back into the fray for wave after wave.

The Lords and Heroes are powerful combatants, though. Unlike previous *Total War* games where the general led from the back, close enough to provide benefits but not close enough to be slaughtered, in *Warhammer* they're some of your best fighters. Though their loss is still devastating to morale, and undead armies can crumble after a general's death, I charge in anyway out of both necessity and a desire to watch their animations as they wreak havoc.

LORDS OF THE THINGS

At the start of a campaign you choose which of two Legendary Lords will lead

your faction, recognisable and legendary *Warhammer* characters such as Emperor Karl Franz and High Wizard Balthasar Gelt, with the other character becoming available during the campaign. Each has their own questlines to pursue: storylines that unlock special battles to earn unique artefacts. These challenging quest battles can also be played outside the campaign in a separate mode of their own.

Though early quest destinations are near the starting positions, they quickly pop up much farther away. Sending your Lord off with an army strong enough to beat them is a bad idea, as even with another powerful stack of troops at home it leaves you open to a concentrated attack, like a sudden Waaagh!

Heroes are both tough individuals who can embed within your armies and agents who can deploy across the turn-based campaign map to perform specific actions. Heroes assassinate

and corrupt, damage walls as well as buildings, reduce income and public order, or improve those things within your own borders.

Sometimes the *Total War* game underneath pokes through, creating situations that don't feel right for *Warhammer*. When Dwarfs defeat Greenskins they have an option to ransom their captives for cash, a decision I can't see either side agreeing to in the fiction.

One of the most *Warhammer*-ish things is Chaos. After 20 turns warnings appear: Chaos gathers in the north. It's another 50 turns before I notice their effects, a spreading corruption like the undead's. As the computer turns whiz past, the pause while the Chaos Warriors move grows longer and longer as their numbers grow. It's past turn 100 before I engage with them, but by then the northern Old World is in ruins, and Archagon The Everchosen is leading a doomstack, and it's coming right at me.

SPOILERS OF WAR

But you should encounter Chaos for the first time for yourself. It's a tale of nations squabbling when they should unite, but even as darkness draws closer the acrimony between me and my foes, combined with the desire to take their territory, stops me from committing to confederation. The end times came and I ignored them, pretending it wasn't my problem until it was too late. Fool on me.

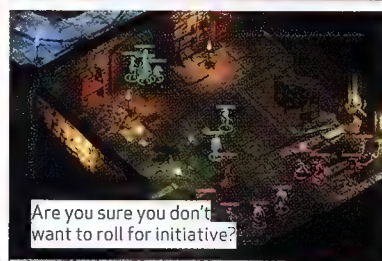
The best *Total War* games have always been the most focused, whether on a single nation or a single general. *Total War: Warhammer* bucks a trend – it takes in a continent but tells one story, and it's all the more potent for that.

■ Jody Macgregor

Verdict

If you find real history a bit bland compared to glorious nonsense, then this is the *Total War* for you.





US\$19.99 (REQUIRES BALDUR'S GATE: ENHANCED EDITION) | PC | SIEGEOFDRAGONSPEAR.COM

Baldur's Gate: Siege of Dragonspear

15 years later, Baldur's Gate expands.

As a historical artefact, *Baldur's Gate* is important. As an RPG, it's huge and expressive. But as a moment-to-moment experience, it can be something of a chore. *Siege of Dragonspear* is an expansion for *Baldur's Gate: Enhanced Edition*. As an add-on – albeit one that takes the form of a full length campaign – it's forced me to reevaluate if *Baldur's Gate* is actually worth expanding.

The D&D ruleset feels awkward and restrictive. Melee combat involves watching sprites wave weapons at each other until invisible dice register a hit. Detecting traps requires walking a few paces in a dungeon, stopping and waiting to see if your Thief signals danger. If she doesn't, take a few more steps and repeat. If she does, disarm it. Then take a few more steps and repeat. There are a lot of traps.

It seemed fine in 1998. It even worked in the *Enhanced Edition*, where, despite the frustrations, it felt important to hold true to the original experience. But as a campaign released in 2016, the rougher edges feel more pronounced. As much as I loved the Infinity Engine, that style is being replicated more smoothly in *Pillars of Eternity* and *Divinity: Original Sin*.

Modern sensibilities aside, how does *Siege of Dragonspear* work as a new *Baldur's Gate* chapter? Pretty well, for the most part. The story fills in the gap between the first and second game, opening with a dungeon filled with Sarevok's remaining followers, then moves on to you – the Hero of Baldur's Gate – out to stop Caelar Argent, the Shining Lady, who's leading a crusade in the north. While your path is somewhat restricted, *Siege of Dragonspear* works well as an RPG. I found numerous

opportunities to talk my way out of fights, or engineer interesting solutions to quests. That said, the dialogue options feel more restrictive than in *Baldur's Gate* proper. Many responses fit into three categories: good, neutral and evil, where evil really means being a bit of a dick. Overall, though, the writing's quite good.

There's a greater sense of spectacle, too. This is the most populated *Baldur's Gate* has ever felt, with huge crowds gathering on the streets. That also manifests in combat. Individual encounters feature a greater number of enemies, and focus is more on crowd control than systematically clicking on enemies in order. It can feel like a battle of attrition but I appreciate the chance to try new tactics.

The *Enhanced Edition*'s reworked interface is barely fit for purpose. Simply navigating through the different menus is a pain and the new journal seems less

intuitive than the old one. And, while an effort has been made to pretty up the graphics – mostly by zooming the camera out to an absurd level – there's no hiding the fact this is a 15-year-old engine.

As a *Baldur's Gate* adventure, *Siege of Dragonspear* works well. While the tone isn't entirely consistent with the original series, it does a good job of inserting itself into the middle of the story without feeling like sacrilege. As a result, though, it requires that you still be invested in that story. The fact is, a decade and a half later, there are much smoother, more enjoyable RPG experiences available. ■ Phil Savage

Verdict

Beamdog has proven it can continue the *Baldur's Gate* story, along with the antiquated nature of the games.





US\$39.99 | PC | OFFWORLDGAME.COM

Offworld Trading Company

A pitiless management sim about exploiting people, prices and planets.

This is a strategy and management sim on Mars. You take control of one of four factions, founding a business dedicated to supplying new human colonies. It's your job to play the market, manipulate the price of resources and put your rivals out of business. That might sound like something only an awful investment wank with four phones attached to his face would love, but it's one of the most immediate, intelligent strategy games I've played.

You have to watch what other factions overproduce, then exploit them. If your opponent has a surplus of water, the price will drop and you can invest in farms, producing food you can sell at an inflated price. This is the foundation of *Offworld Trading Company* and the thing that initially took me a while to understand. There are no tanks or troops. Your weapons are price fixing and corporate espionage. Your ultimate goal isn't to destroy your opponent, but to absorb them via hostile takeover. It's different from more

leisurely strategy games in that it's short form – games can be over at any stage, resources allowing – and if you just feel like laying back and colonising Mars, you'll simply get devoured. This isn't an RTS with the combat removed – it's Wall Street on a new frontier. It's a tricky thing to describe, let alone play, but thankfully there are some rugged tutorials to ease you in. They expertly explain the basics, such as price fluctuation, patents and buying shares in your opponent, and also more nefarious practices such as price gouging and market manipulation.

The campaign is an extension of the tutorial, and offers a different way to compete. There are nine CEOs from different companies, each with their own identity and limitations. You'll have to invest money in engineers to build certain advanced structures, and every challenge is different. Many of the games I played came down to desperate, last-minute purchases of shares, racing to sell enough stock before the final buzzer.

Then there's 'skirmish'. It's

built on a system that's endlessly evolving, reactive and intimidatingly smart. No two games play the same, and it's only predictable in an abstract sense. You know that certain advanced goods generally sell at higher prices, but the circumstances leading to that point change in every game. It demands a level of agility I'm unused to in strategy games, and that's exactly what makes it exhilarating. The sterile roshambo of simpler titles is almost completely absent here. No single tactic will effortlessly sweep you to victory.

It's a difficult game to review because I'm probably not good enough to enjoy it the way I should. It says plenty about *OTC*, then, that I still completely love it. ■ Matt Elliott

Verdict

Master its complex systems and *Offworld Trading Company* is ruthless, immediate and thoroughly rewarding.



Fallout 4: Automatron

Make a new friend.

US\$9.99 | PC, PS4, X1
FALLOUT4.COM

T1-MMY is a hovering orange rustbucket – the ramshackle result of whatever mods and components I had lying around my home base. He has a cryogenic blaster on one hand, an oversized vice on the other. Like Dogmeat, Timmy doesn't judge me for picking locks or stealing telephones. Unlike Dogmeat, his hand can be replaced with a flamethrower. He's the result of *Fallout 4: Automatron's* robot workbench, where you can construct metal pals from spare scrap. It's an excellent addition that lets you mix-n'-match parts – an Assaultron head here, a Protectron arm there. It's hardly essential. *Fallout 4* already has plenty of companions. But there's something about constructing your own Frankenbot that taps directly into *Fallout's* weird science. If robot crafting was all there was to Automatron, I'd feel more positive about the whole package. But it's hard to get enthusiastic about more dungeon-crawling through the decrepit ruins of a post-apocalyptic Boston. *Fallout 4* is already full of that. If Automatron was a sidequest within the base game, it'd be one of the better ones thanks to its campy, occasionally dark story. As an add-on, it doesn't have the conceptual strength of *Fallout 3's* DLCs. I'm glad I have *Automatron*, because now I've got T1-MMY – a robot friend to accompany me on future escapades. Robot crafting is a good idea, and well executed. But it's all tied to an adventure that isn't very adventurous. ■ Phil Savage

downtime » chip chat

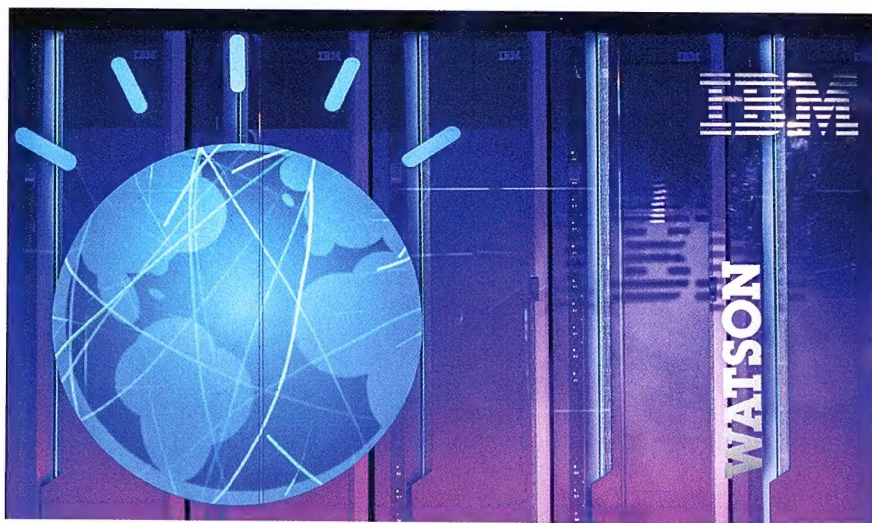
» CARMEL SEALEY REPORTS ON THE LIGHTER SIDE OF TECH NEWS



Wales creates history

With world-first selfie bench.

There is currently no end in sight to the absolute torrent of selfies being taken and uploaded to the internet (most of which have very poor sense of composition). Take a walk near a local landmark and you'll be guaranteed to spot a few individuals with selfie-taking arm raised, trying to angle their phone to get themselves and the view into picture. Wales (home of King Arthur) has decided to help these people out by establishing the world's first selfie bench — a chair facing away from the scenery, so people can sit and snap against a great backdrop. Talk about fanning the fire, guys...!



I'll be back... to mark your essay.

PROFESSOR FOOLS STUDENTS WITH AI TEACHING ASSISTANT.

Chatbots are becoming more and more common in today's society, but it's a long way off before we see them in the classroom, right? Well, computer science professor Ashok Goel from the Georgia Institute of Technology decided to employ the help of a robot teaching assistant in place of a human aide to tackle the mountain of student-sent emails each semester. Powered by IBM's Watson system, the bot (named Jill Watson) answered students' questions via email, reminded them about upcoming assignments and even instigated midweek topics of discussion. Not all the students were fooled, but most did not question the responses they received.



US teen causes car accident while using Snapchat

VICTIM SUES SOCIAL MEDIA.

Snapchat has all kinds of filters but the one that displays the speed at which you're moving has landed the social media with a lawsuit. A female teen wanted to see how fast she could push her Merc on a suburban street on the outskirts of Atlanta. She accelerated up to 133 miles per hour (182km/h), whereupon she hit an Uber driver and landed both of them in hospital — he with permanent brain damage and she with a cut on the head (of which she took a selfie). Consequently, the Uber driver is now suing Snapchat for negligence, saying that the social media company did not restrict access to the app while driving, insinuating that the filter itself encouraged fast and dangerous behaviour while behind the wheel.

Forget the smartwatch, smart fridge or smart mirror

SAMSUNG SAYS WHAT YOU REALLY NEED IS A SMART SURFBOARD.

What comes after the smartphone (apart from AI taking over the world and human extinction)? Samsung seems to think the next leap in smart technology is to apply it to a surfboard. Now, we know you must be saying, 'Guys, it's July now. Pack that April Fool's Day stuff in, will you?' but we're being serious. In a commercial, Samsung Brazil has promoted the concept of a surfboard featuring a large LED display powered by a Galaxy S7 inserted into the base of the board itself. While the Twitter-connected aspect of this idea is a bit ridiculous, the weather feed could actually be useful for a surfer. At the moment, we're not quite sure how far Samsung will take this marketing gimmick — could this be the new wave of tech? ■

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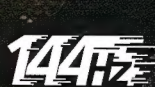


AOC GAMING



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